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University Growth-poles and the Canadian Aggregate Situation

By

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ABSTRACT

The utilization of higher education resources in a regional development function has become an increasingly popular ploy within the realm of government policy. The university, typically through an interaction with today's growth-inciting high-technology industry, has tended to replace the traditionally-used manufacturing plant as the 'new' growth-pole.

It is likely that no other single institution could benefit a region in as wide an array of economic and social capacities as can the university. And, it is with respect to this notion that a Canadian university study was pursued.

However, where most university 'impact-type' assessments have tended to look at individual cases, this study considers all of Canada's universities simultaneously. Specifically, then, this aggregate analysis sought to answer three fundamental questions. Firstly, are universities in Canada acting as growth-poles and thereby influencing a higher level of well-being within the regions that they dwell? Secondly, if so, how far does this 'prosperity' extend over space? And, thirdly, are there some underlying factors that may allow for the 'university-pole' to be successful in encouraging regional advantage?

Table of Contents

List of Figures

List of Tables

CHAPTER 1 - INTRODUCTION

Few, if any, would dispute the value of universities in preparing a more educated and socially adaptable population. Indeed, a nation's overall level of future prosperity relies heavily on the quality of higher-education available within its borders. Truly, the need for universities to continue transforming a populace into a workforce which most adequately matches the requirements of future employers is hardly a debatable topic. Yet, what is not as readily apparent is the role a university can conceivably play beyond its obvious academic function; namely, as a mechanism which encourages a relatively higher level of economic well-being within a roughly definable immediate area. Such a condition would normally be accomplished via the creation of research interrelationships between local industry, specializing in occupations requiring high levels of skill and education, and the university, participating in a training and/or advisory role (Downer,1986,240-310). Within this context, the university, in ideal terms, takes on a growth-pole appearance and through the formation of additional employment and investment opportunities in, most importantly, the quaternary sector, wealth is created throughout the immediate area as linkages multiply and in turn stimulate other less related types of economic activity.

The quaternary sector has become increasingly critical to a nation's future economic development. This sector is loosely defined as those tertiary activities which require much education and training and, therefore, close ties between quaternary industries and universities seems not only intuitively logical, but optimally necessary as well (Gottmann,1961,576). And, of course a significant proportion of quaternary endeavours take the form of so-called high-tech activities. These 'state-of-the-art' growth industries, such as Robotics, Telecommunications, Computers, and Semiconductors, have contributed substantially to economic expansion, national

productivity, employment opportunities, and the enhancement of the competitiveness of other sectors (Paul,1984,2). The role of universities in attracting and nurturing the advancement of the quaternary sector, and in particular the high-tech sector, is therefore well within the national interest but in addition, potentially beneficial in a regional sense. as areas which possess successful quaternary industry stand to experience economic gains.

Of course, if one subscribes to this notion of a university growth-pole, then it follows that such a topic would have implications for government policy and, in particular, the development of slow-growth regions. The growth-pole/centre analogy is not a new form of policy in Canada. During the late 1960's and early 1970's, similar type strategies were implemented, typically using secondary industry growth-poles, but successful applications were very limited (Economic Council of Canada,1977,160). Yet, would a similar strategy using a university be more successful today? Or, to further qualify the question, are universities today acting as growth-poles and thereby inciting growth (through linkages) within the regions in which they dwell?

Essentially, the intent of this thesis is to fully expand on this notion of universities posing as growth-poles and correspondingly, to understand the extent to which quaternary industry-university linkages influence a relatively higher level of prosperity within the immediate region. Or, to phrase the intent slightly differently, are growth-centres emerging on the strength of, firstly, where universities are located in space and, secondly, on the influence of university-quaternary industry relationships?

The notion of university growth-poles and the influence of quaternary industry-university linkages, then, relies on two general bodies of literature for justification. Namely, those writers whom have pioneered and expanded upon the merits of a university in a regional development capacity, and the various publications which have delt with the mutual benefits of industry-university relationships. Incidentally, when consulting the literature for justification, it is

typically necessary to treat these ideas in isolation because rarely have writers delt with both simultaneously. Which is to say that, much has been written on universities as inciters of economic activity (and inherently referred to as growth-poles) and on the attributes of well-entrenched university-industry linkages but seldom from the point of view of the latter influencing the former.

Thus, with regards to the question of un' rsities and their possible role in regional development activities, it is necessary to understand what a growth-pole strategy, in general terms, involves. The work of Schumpeter (1934), Perroux (1955), Myrdal (1957) and Hirschmann (1958) adequately shows: the link between innovation and regional development, the definition of growth-poles, the ramifications of growth-poles, and the relationship of growth-centres to their peripheries; respectively. These classical studies, although all taking the 'industry' growth-pole point of view, create the initial justification for this university study.

And, in fact, university regional schemes have been effectively utilized. Sweden's economy became more regionally balanced when university campuses were strategically placed in Northern cities (Lane,1984). A similar situation occurred in Finland when higher-education resources became more widely dispersed away from the major cities (Antikainen,1981). And, in North Carolina the so-called Research Triangle Park, which is surrounded by three university campuses, has greatly improved the economies of nearby cities through job creation and increased local expenditure (Annual Executive's Guide,1988). The greater concentration of high-tech industry, attracted by the universities, appears to have been the critical factor in achieving a higher level of prosperity in each respective situation.

Indeed, it is this quaternary industry-university attraction that is perhaps the key component in these growth-pole applications. Typically, these liaisons will take the form of either consultantships, affiliate programs or research parks and, except in the case of Research Parks

where the industry becomes physically part of the campus and benefits from all university facilities, the faculty will become actively involved in an advisory role for industrial affairs (Downer,1986). A good example of this type of effective relationship is illustrated by the linkage between Clay Nurseries and Simon Fraser University in which both parties became involved in a tissue culture process to speed up the maturation of shrubs and trees (Science Council of Canada,1987). Or, the liaison between Willowglen Systems Ltd and the University of Calgary also examplifies how universities can participate in the transfer of technology to industry. Here the development of a computer software package to aid in continuous flow processes, in oil and gas operations, is the task being pursued (Science Council of Canada,1987).

Hence, the understanding that universities have been used in regional development schemes and that university-industry relationships are becoming a common, and even crucial, occurrence is vital to accepting this growth-pole arguement. Yet, it is necessary to alter the scale of this discussion and see as well what a university does for a community at a micro level. Which is to essentially ask how, then, does a university specifically create a spatially immediate prosperity?

In addressing this question it is necessary to separate the effects from a local university into direct and indirect community influences. The difference being that the direct effects are those which can be unambiguously attached to the local university, whereas, the indirect effects are caused in part by the university but are directly the result of some other agent.

Direct local influences can in turn be both economic and social in nature. And, frequently, economic effects are measured through so-called impact studies. Caffrey and Isaacs (1971) are often complimented for producing perhaps the optimal modern-day 'framework' for university impact assessment and, as a result, many studies have consulted their study. By designing a series of cash-flow formulas, the authors were able to create applicable models that can be used to estimate how much wealth is being generated directly by a given university. Lewes and Kirkness

(1973) did an impact study of Exeter University in England, using the Caffrey and Isaacs approach, and projected that 11 to 13 per cent of the local economy will [illegible] two years, depend upon the normal operations of the university. The local spending of the students, faculty and staff were isolated as the most significant factors concerning the university's economic impact on Exeter.

Non-economic direct impacts, although totally unquantifiable, can be just as beneficial to a community that is in close proximity to a university. The university can act as a 'community doctor' and, by way of faculty led workshops, help to alleviate various social tensions created through common urban problems which become visible through escalating crime, discrimination and housing difficulties. An example of this city-university collaboration is outlined by Mitchell (1974) in which participants from the University of Pennsylvania have formed an organization to look into the social problems confronting the Philadelphia area. And, according to the author, a good degree of social tension has been alleviated as a result of this ambitious project.

Thus, the social effects of a local university can be just as important as the economic ones; but, strangely, most studies tend to address only one or the other and therefore much comprehensiveness is lost. Having said that, though, a recent study of York University by Found (1988) does attempt to reveal the 'total' university influence. Not only does Found establish that the ecomomic impact, for the city of North York and Metropolitan Toronto, is nearly 400 million dollars per year but, also outlines the massive non-economic service the university performs for the region. In effect, the author is claiming that the university is a true societal leader in both economic and social terms.

Universities also effect their surroundings in less obvious indirect ways, but the impact is not any less significant. Specifically, two criteria (high-tech industry and trained graduates) which through a definite interaction with the university can in turn greatly influence a region's socio-

economic standards. The university by training, motivating and directing its students creates an on-going outflow of workers which typically evolve to become the elite in society with regards to job importance and earning potential (Cousineau and Vaillancourt,1987). Accordingly, then, regions that are relatively rich in trained university graduates tend to out-perform other destinations economically. In a similar fashion, regions possessing a comparatively higher proportion of high-tech industry, today's growth inciters, benefit from a more enhanced local well-being as well. The Silicon Valley and Route 128 situations well illustrate the massive positive impact that a thriving high-technology sector can have on a region's level of prosperity. Thus, indirect university influences are a significant portion of this university growth-pole analysis as well.

Following this first introductory chapter will be two chapters expanding on the issues presented thus far. In particular the second chapter will present a literature review of, firstly, classical growth-pole theory, secondly, examples of real-life university growth-poles and, thirdly, functioning quaternary industry-university linkages. Chapter 3 will provide a micro view of what universities can do for their surroundings and address both direct and indirect influences. From there, then, the theoretical basis is set for the fourth chapter's 'university aggregate analysis'. This empirically-based chapter will pursue the central theme of this thesis: namely, are universities acting as growth-poles in Canada and thereby influencing a higher level of well-being in the regions in which they dwell? And, assuming the affirmative to this inquiry, other questions surface such as: is this superior level of well-being localized, is it attributable to the creation of growth-centres through university-industry relationships, and are there some other underlying, perhaps social, factors that can explain any dominance university communities may exhibit? In order to adequately answer these questions, three simple statistical techniques (analysis of variance, T-test and regression) will be utilized. Chapter 5 will feature a discussion on the results

attained in Chapter 4 and offer some concluding remarks.

CHAPTER 2 - GROWTH-POLES, THE NEW ROLE OF UNIVERSITIES (EVIDENCE FROM THE LITERATURE)

The emphasis of this chapter is to find support in the literature for the university growth-pole argument so that the theoretical framework, to be established in the next chapter, and the empirical analysis of Chapter 4 will have some substantiation. Illustrating the existence of real-life 'university-poles' and the importance of on-going university-industry relationships is the dual purpose of this chapter. However, before these tasks can be accomplished, it is vital to review briefly some of the critical foundations of classical growth-pole theory.

2.1) The Growth-pole Argument

The growth-pole/centre analogy, so often witnessed in the literature and in actual application, is one rather popular component in a large group of strategies concerned with regional economic development. In that, the growth-pole is best viewed as an agent of economic development. And, as J.A. Schumpeter, in the publication The Theory of Economic Development (1934), observed several decades ago, technology is central to the economic development of any region.

> By development, therefore, we shall understand only such changes in economic life as are not forced upon it from without but arise by its own initiative, from within. Should it turn out that there are no such changes arising in the economic sphere itself, and that the phenomenon that we call economic development is in practise simply founded upon the fact that the data change and that the economy continuously adopts itself to them, then we should say that there is no economic development. By this we should mean that economic development is not a phenomenon to be explained economically, but that the economy, in itself without development, is dragged along by the changes in the surrounding world, that the causes and hence the explanation of the development must be sought outside the group of facts which are described by economic theory (Schumpeter,1934,63).

Schumpeter looks at the basic principles of economic life in the first chapter of this book and sees them as highly inter-related in a 'circular flow' and as never-changing. Which is to say that the theories that pertain to the laws of supply and demand and the economic system's tendency towards equilibrium position allows for the calculations of commodity price and quantities of goods traded and is applicable to any data set existing in any era (Schumpeter,1934,62). By contrast, economic development, by its very nature, implies change to the economic system, accomplished via progressions in technology from within. Thus, only through internal innovation is economic development attained. And, it is this notion that comprises the initial justification for this paper's university growth-pole emphasis. Clearly, there is an over-riding importance for a community, region or nation to continuously build upon its immediate technological initiative and relatedly, then, it is evident the role that universities can play in nurturing regional development in this regard.

Schumpeter's views have tended to remain rigidly intact throughout the years. However, today there is a sense of urgency which has surfaced in much of the Canadian literature regarding the need for Canada to become more competitive in high-technology endeavours, as Douglas Wright implies:

> More and more, we are starting to recognize that the key to our economic competiveness and well-being, and perhaps to Canada's very survival as an independent nation during this coming era of rapid and continuous change, will lie in our ability to find a way to keep up-to-date technologically (1982,1).

Wright, in his article "The Universities and Canada's Economic Future", believes that unless Canada moves firmly into a competitively efficient level of high-tech manufacturing, countries already more technologically able (such as Japan, the United States and the countries of the EEC) will effectively destroy Canada's domestic manufacturing and, therefore, a major source of national wealth. Yet, the author concludes that Canada can become more competitive in the high-

technology markets if the universities lead the way.

> It seems evident that the key to any country's success in the future, Canada included, will depend more and more on our human resources and less and less on our acknowledged wealth of natural resources. The way to develop our human resource is, primarily, through our educational institutions (Wright,1982,3).

One could interpret Wright's call for greater high-tech efficiency in Canada as an application of Schumpeter's theory that regional economic development occurs only through internal innovation. The phrase 'universities leading the way' to development and prosperity by encouraging innovation is a simple, but effective, way of outlining what a university growth-pole is to accomplish. Yet, at this point, it is necessary to more concisely discuss the general growth-pole/centre analogy from the point of view of classical theory.

The basis of growth-pole related ideas owes its origins to, primarily, three scholars who were intent on studying the various means of regional development. Francois Perroux (1955), Gunnar Myrdal (1957) and Albert Hirschman (1958) had all contributed greatly to fostering and developing this notion of growth-poles and their related attributes. The growth-pole concept was first advocated by Perroux and evolved out of the author's recognition that:

> the spatial distribution of economic activity does not fluctuate around a long-term equilibrium norm, but tends to promote the concentration of growth in some areas at the expense of other. As he (Perroux) says, 'the plain fact is that growth does not happen everywhere at the same time; it shows itself in certain points or growth-poles, with different intensities' (Holland,1976,49).

Perroux used the actual term 'growth-pole' to describe an influential institution (usually an industry).

> His basic idea of a growth-pole is that once a 'key-industry' has been installed within a region, the whole economy will improve through forward and backward linkages with this 'key-industry'. A 'key-industry' is characterized by very high growth rates, a high degree of intra- and inter-industrial dependency, as well as having a dominant position in the market (Pletsch,1982,160).

So, once an initial 'triggering event' occurs where the growth-pole emerges within a given landscape then, theoretically, all sectors and establishments in contact with this leading institution flourish accordingly. And, depending on where these linkages extend to over space, growth-centres can result from this process as well.

Growth-centres are actual places and therefore are necessarily spatial in nature; which set them apart from growth-poles which need not be spatial at all. Aside from this fundamental difference, however, growth-centres (an influential place) will ideally set in motion forces similar to those incited by growth-poles (an influential institution). Hoover (1971,277) defines growth-centres as;

> places where there exists or can easily be created the necessary condition for expanding employment opportunity and especially the public infrastructure and the external economies that most activities require. Such growth-centres are then expected to attract commuters and migrants from surrounding areas of labour surplus and at the same time stimulate secondary growth of employment in some of these areas.

The ideal growth-centre, whether created naturally or as a result of government planning, will encourage the economic development of less fortunate surrounding areas, through spatial linkages, and eventually create an equilibrium of well-being over space. Therefore, the economic development of peripheral regions, when employing a growth-pole/centre strategy, are facilitated by linkages to other institutions (via the growth-pole) and by connections to the surrounding peripheries (from the growth-centre).

Yet, a growth-pole/centre can not be deemed a success if its area of influence is extremely localized over space. According to the literature, once a growth-pole is established and a growth-centre subsequently results, the potential for significantly developing the surrounding peripheries depends on the strength of what Myrdal calls 'backwash' and 'spread' effects (or, using Hirschman's terminology, 'polarization' and 'trickle-down' effects respectively to mean the same thing).

Backwash effects are caused by the expanding need for growing regions to capture resources. Once a region becomes receptive to a growth-pole and begins to prosper as a result, flows of capital and labour are enticed into the area, often at the expense of declining regions. In this way, the potential for periphery development becomes retarded as resources are attracted into areas of affluence leaving the disparity gap in well-being over space reinforced. So, if backwash effects are excessively strong, the outcome of the growth-pole/centre strategy will be inevitably disappointing to regional developers.

If, however, spread effects outweigh the influence of backwash effects, areas surrounding the growth-centre, and in contact with the growth-pole, can prosper in response to linkages with the influential institution. Hirschman suggests that these spread (trickle-down) effects can take the form of purchases and/or investments made by the growth-pole in surrounding peripheral areas. Ideally, the peripheries will develop via their contacts with the growing region and eventually reach a state in which growth is self-sustaining. In such a scenario, the growth-pole/centre application would be successful in achieving the typical goal of regional developers; namely, a more equal balance between growing and depressed regions.

It should be realized that both spread and backwash effects tend to operate simultaneously and are not working in isolation of one another within a given landscape. It is the relative strength that one effect may have over the other that will determine how successful a growth-centre is in shrinking its surrounding periphery. In other words, if spread effects from the growth-centre (linkages from the growth-pole with other establishments in the periphery) are well entrenched then, in theory, the peripheries should strengthen and, of course, the reverse is true if backwash effects dominate.

The majority of growth-pole/centre strategies, both theoretically studied and actually applied, have considered the approach assuming that an industry would play the role of the influential

institution. However, given the research-oriented nature of universities and their inherent ability to attract and work with high-technology firms, it seems entirely reasonable to believe that a university could act as a growth-pole and potentially incite regional prosperity. Theoretically, then, Schumpeter's prerequisite for economic development is met as universities specifically encourage internal innovation and, as the next section will show, actual 'university-pole' applications have been successfully realized.

2.2) Universities and Regional Development

A good example of how higher education resources can be used in a regional development capacity is outlined by Jan-Erik Lane (1984) in his article "Higher Education Regionalization". Here, the author looks at the socio-economic changes that have occurred to the northern provinces of Sweden ("Norrland") since the construction of university campuses in various northern communities. The entire process took approximately 21 years, from 1956 to 1977; a time-frame that the author considers to be quite short.

Prior to 1960, levels of well-being between the north and the south of Sweden contrasted strikingly. The northern provinces, although rich in resources, contained a comparatively poorer and considerably more scattered population which suffered from the consequences of massive structural and seasonal unemployment problems. Social care facilities for northern residents was less available as well with a severe lack of medical and dental professionals. In addition, higher education was exclusively situated in the south. Thus, an outward migration of the Norrland's young and intelligent became necessary if these individuals sought higher training; which, of course, only added to the northern area's plight.

Therefore, in efforts to combat this obvious pattern of regional disparity the Swedish government began to contemplate reforms to higher education allocation and the potential benefits

that university facilities could bring to the north. But, as Lane reveals, it is a mistake to interpret this 21 year process of university settlement in the north as a coordinated regional development scheme when, initially at least, it was really the result of individual cities (Umea and Lulea particularly) competing for much needed training facilities.

> The introduction of a system of higher education in Norrland coincided with the expansion of the Swedish system of higher education. This parallel is not just a simple fact, but constitutes one explanation of why a 'University of Norrland' was created so late (Lane,1984,354).

And, due to the impressive local initiative of several northern cities, university resources emerged very rapidly in the 1960's and early 1970's. The most significant events occurred, firstly, in 1963 with the opening of a university in Umea and, secondly, with the establishment of an institute of technology in Lulea in 1971. Umea also benefited from the opening of dental (1956), medical (1959) and teacher-training (1967) schools. Lulea also built a teacher-training complex in 1968. Other northern cities soon followed with smaller-scale education facilities of their own; of particular significance is the opening of the School of Higher Education in 1977 with campuses in Sundsvall and Gavle.

The expansion of university resources into the north has helped to meet the increasing demand for higher education, a goal in itself, but has also become a viable instrument for regional development.

> Concerning service to the region, it is trivial to state that the allocation of the institutions of the University of Norrland has been condusive to the socio-economic development of the northern provinces; firstly, these institutions have contributed to secure employment, in a part of Sweden where unemployment and insecure employment have been major problems. The allocation of a system of higher education to Norrland not only had the result that northern students received an alternative to moving to the south; it also increased social mobility in Norrland because it opened up access to higher education to underprivileged groups who might not have considered higher education at all if it had not been available in their native province. (Lane,1984,355).

Of perhaps even greater consequence, is the reduction in the shortage of doctors and dentists since the introduction of higher education to Norrland. Lane establishes that better than 50 per cent of the doctors and dentists trained in Umea, many of which originate from the South, stay in Norrland.

Similarly, more than half of the students who have graduated from the Institute of Technology at Lulea have stayed to work within Norrland and help to create a more progressive local economy which is better suited for the post-industrial era. Like the graduates, innovative high-technology firms have been attracted to the area because of the College's research activities. Lane identifies at least ten such firms.

Thus, the 'University of Norrland' is contributing to the diversification of an industrial life that used to be dominated by mining and ironwork towards more growth-oriented high-tech activities. As well, social and medical facilities have been improved, employment and training opportunities increased and the cultural aspects of society enriched as the northern economy and way-of-life has become increasingly more receptive to, essentially, a university-driven environment.

Another example of how universities can drastically alter their immediate environment in terms of socio-economic development is outlined by Ari Antikainen (1981) in his article "The Regional Impact of Universities in Finland". The circumstances surrounding the decentralization of university resources out of the most populated centres of Finland bare a great resemblance to what Lane revealed in his Swedish example.

Up until the 1950's, higher education was concentrated in the two biggest cities in southern Finland, namely Helsinki and Turku. However, by the late 1950's and there after, university campuses emerged throughout the country.

> The University of Oulu was founded in Northern Finland in 1957. In 1960 the College of Social Sciences was moved from Helsinki to Tampere, where it was extended to a full university in 1966, at the same time as Jyvaskyla College of Education became the University of Jyvaskyla. In the same year three new

> universities were established in eastern Finland, where Lappeenranta University of Technology and the University of Joensuu started their operations in 1969 and the University of Knopia in 1972. In western Finland the Vaasa School of Economics was founded in 1966. The newest University, that of Lapland, in Rovaniemi, was created in 1979. Thus, the country has developed a decentralized system of higher education within a relatively short period (Antikainen,1981,437).

The benefits of this creation and reallocation of university resources has been a regional balancing of well-being across Finland and the promotion of a more pronounced industrial and post-industrial emphasis in many of Finland's previously resource-led communities; a situation which almost perfectly echoes the Swedish application.

However, one critical point must be made with regards to how Antikainen and Lane interpret the university's role in fostering regional economic development. Where Lane sees universities as able to encourage a region's advancement towards post-industrial activity, Antikainen stresses the necessity of such an outcome.

> The findings (from the Finnish situation) suggest that the change from agrarian to an industrial or post-industrial society has given rise to the assumption that higher education is a part of the social infrastructure in the world of scientific-technological revolution (Antikainen,1981,437).

In other words, Antikainen is claiming that regional change through either technological advancements or the nurturing of innovation is not possible without university influence. Therefore, not only can universities be used as vehicles for regional development but, if this advancement is to occur through high-technology involvement, they must be utilized. In this sense, then, universities are essentially growth-poles for innovation, and innovation is in turn the catalyst for regional development.

The emerging popularity of research parks in the last couple of decades has left its mark on the, predominantly American, socio-economic landscape. Typically, these designated 'parcels of land', set aside for research-oriented activities, work in close conjunction with a local university

and therefore any level of regional development a[illegible]ed through the park's operations must also be considered to be a result of the close proximity of the u[illegible]iversity. The Research Triangle Park in North Carolina is a good e[illegible]ple of such a situation and, as well, provides further evidence regarding the validity of th[illegible]s university growth-pole argument.

The Research Triangle Park owes its origins to Dr. Howard Odum, a professor at the University of North Carolina, who recognized in the 1940's that the local universities could support research activities by pooling their human and financial resources. Barry Moriarty explains that:

> the Research Triangle Park lies 15 miles by highway from Raleigh and North Carolina State University, 7 miles from Durham and Duke University, and 12 miles from Chapel Hill and the University of North Carolina (Figure 2.1). These universities jointly have been prime movers in the creation of RTP. An appropriate statement has been made that the Research Triangle Park is an area in which scientific investigations are carried out in accord with the principles that research and education are necessary forerunners to industrial growth (1986,1).

And, econom[illegible] growth through-out the state of North Carolina has resulted largely through the park's ability to attract research-oriented high-tech growth industries into the area.

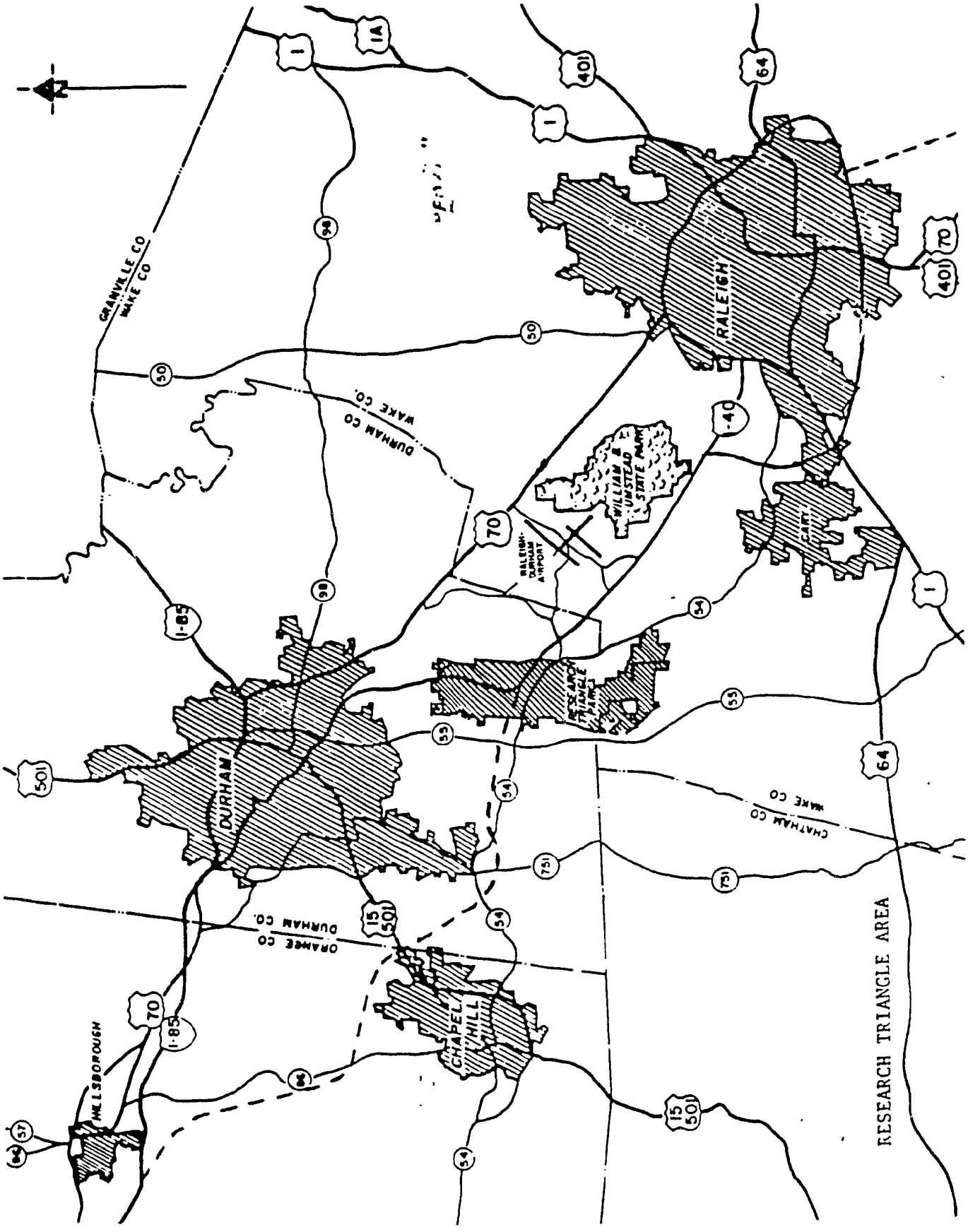
An enormous amount of wealth is generated by the high-tech firms within the park.

> Collectively, the 38 organizations currently quartered in the park employ over 23 000 people in facilities comprising over 10 000 000 square feet of building space In 1985, annual payrolls were estimated at one billion dollars and plants and equipment were assessed at slightly over one billion dollars for tax purposes. The park's largest single employer, which also has the largest installation and the greatest plant investment, is IBM with 8 500 people employed in the park and in the surrounding Triangle area (Moriarty,1986,3).

But, it is the activities outside, and created by, the park which have most directly benefited many communities in North Carolina. Moriarty stresses the over-riding importance of the park's 'incubation' [illegible]nction.

> The principle reason for selecting development of an industrial research park as the means for stimulating economic development in North Carolina was its function as a breeder of new manufacturing plant development and expansion in other parts of the state by the industries having research and development

Figure 2.1



Source: "Research Triangle Park: 1956-1985". B.Moriarty. Department of Geography, University of North Carolina. (1986) pp.1?

facilities in the park (1986,4).

The Research Triangle Park was created to provide a forum for high-technology enterprises to carry out research and development endeavours. Yet, as new products are developed, they will ultimately need to be put into production. Thus, the establishment of 'satellite' manufacturing plants outside of the park has occurred and state wealth has been enhanced noticeably.

For instance, Charlotte North Carolina has evolved into a true growth-centre in the last two and a half years largely through the massive expansion of its suburban office market. This high growth rate:

> was fueled by new firms moving into the area, as well as by the expansion of local businesses. Much of this office growth is attracted to the vicinity of the University Research Park, where there is an attractive business climate for new growth (Annual Executive's Guide,1988,25).

Like Charlotte, the economic positions of Raleigh and Durham have been improved through, particularly, the growth of local RTP spin-off industry and via increases in residential settlement. Of the 23 000 employees working in the Research Triangle Park, 60 per cent live Raleigh and 30 per cent in Durham (Moriarty,1986,6).

Therefore, the effect of the Research Park on various North Carolina destinations has been vastly significant. The influx of industry and, generally above average income earning, professionals has clearly contributed to regional economic development. Yet, the underlying factor that has allowed this process of regional prosperity to evolve is the attraction of the universities. Kodak, IBM, Northern Telecom and many other high-tech firms were attracted to the park to take advantage of the innovative atmosphere and availability of trained graduates common to a university environment (Annual Executive's Guide,1988,27) (Research Triangle Park,1988,24). It is reasonable to state, then, that the success of RTP could not have been attained without the closeness, in both geography and interests, of the three university campuses.

Thus, there does appear to be much evidence that university growth-poles seem to exist in the real world and are not just theoretical models presented in the literature. In the cases summarized above, the universities in question have succeeded within a regional development function by encouraging the settlement of innovative high-tech industry into the immediate vicinity. And, as Schumpeter hypothesized several decades ago, it is the nuturing of innovation and ideas within a specific region which will foster prosperity. So, in this sense, the university is really the growth-pole for innovation where success depends on its ability to encourage quaternary activity into the area. Optimally, the result will be the formation of a growth-centre with a shrinking surrounding periphery, if the spread effects from the influencial quaternary industry(ies) outweigh the backwash effects; which, incidentally, is what has prevailed in North Carolina, northern Sweden and the less populated Finnish settings. The various university-industry linkages becomes the initial 'inciting force' in this process and because of their importance, deserve closer attention.

2.3) High-tech Linkages (University-Industry Relationships)

Indeed, the role of the university has matured over time; to such an extent that many perceive it as not only an institution of training for students but, as an advisory body to also serve the business and political communities. Such a trend in thinking has led to an increased awareness of the various forms of university-industry collaborative ventures. Roger Downer's paper "The Role of the Universities in the Development and Transfer of New Technology" (1986) addresses this 'more progressive' role of universities and the various university-industry relationships (UIRR's) in existence.

Downer, although a strong advocate of university involvement in the private sector, stresses from the onset that the primary mission of universities remains unchanged: "to teach/train students and to conduct the basic research that contributes to the pool of existing knowledge"

(1986,340). Thus, the universities are obligated to maintain an adequate outflow of manpower that matches the requirements of future employers and to create an atmosphere condusive to research; but, "to ensure that the intellectual and physical resources of the institution are available to industry and government" (Downer,1986,344) has become an important university function as well. There are various mechanisms that encourage university-industry interaction and Downer groups them into three general categories: consultantships, affiliate programs and research parks.

Consultantships usually refer to a situation where university faculty serve as paid industrial advisor. The industry receives an impartial assessment from in-house research and also gains information about current trends in innovative developments. The university professor, working as the consultant, in turn becomes more professionally competent by participating in practical industrial affairs. Affiliate programs bring the two sides even closer together; in that, businesses are granted an affiliate membership upon payment of a fee. This entitles the member to an office on campus and free use of all the university facilities normally open to faculty. Both parties benefit from an exchange of technological knowledge but, in addition, students gain access to practical issues and the university itself receives supplemental funding through membership fees. Another mechanism that promotes university-industry relationships is the research park. This is a designated area set aside for industry to locate research facilities on land leased by the university (not unlike the North Carolina situation discussed previously). In effect, the corporate employees become part of the university community where access to libraries, seminars, courses and an innovative atmosphere are benefited from. The university in turn capializes on a corporate presence as industrial scientists are often coerced into giving lectures and serving on graduate student advisory committees.

Therefore, consultantships, affiliate programs and research parks are the mechanisms upon which solid UIRP's are formed and recent studies have shown that university involvement in the

private sector has become prevalent.

> In a study of the biotechnology industry, it was estimated that 66-77 per cent of all patent applications resulted from industrially sponsored university research and 41 per cent of the companies surveyed derived at least one trade secret from their sponsorship of university research (Downer,1986,347).

At this point, a more detailed account of actual university-industry relationships might help to further emphasize the mutual benefits that result from such endeavours.

The transfer of technology between institutions of higher education and various profit-seeking enterprises has become an accepted, almost expected, outcome if Canadian business is to remain competitive in the world markets through the adoption of innovation. In a discussion paper prepared by the Science Council of Canada (1987), six case studies concerning R and D links between firms and universities are presented. Two of these studies, Simon Fraser University's collaborative research with the forestry industry and the University of Calgary's link with Willowglen Systems Limited, will be considered here.

In 1983, Clay's Nurseries began an extensive link with Simon Fraser University in British Columbia. The aim of this alliance was to develop an effective means of propagating trees and shrubs using a genetic engineering process known as tissue culture, or sometimes referred to as micropropagation. Essentially, this is a procedure that:

> involves the multiplication of cells of a manually sliced part of a plant bud rather than growing from seed. It allows faster maturation of plants in addition to their exact replication (Science Council of Canada,1987,9)

Simon Fraser's Dr. W. Vidaver served the nursery in a consulting capacity and the funding for the project was provided by the National Research Council, with 100 000 dollars going to Vidavor and 485 000 dollars to Clay Nurseries, and an annual contribution of 12 000 dollars from the Science Council of British Columbia. Other organizations soon became involved in the

project, such as the British Columbia Ministry of Lands and Forests and three other forestry companies pursuing separate, but related, projects with SFU. Eventually, as Figure 2.2 illustrates, the institutional linkages and sources of funding multiplied into a complexity of inter-relationships.

British Columbia's economy, because of its commitment to the forestry industry, has a great deal to gain from this project.

> Currently about 200 million trees are being planted in the province each year, so even a small improvement in survival and growth rates can provide a multimillion dollar payoff (Science Council of Canada,1987,9).

The Science Council has already deemed this linkage as an extremely worthwhile venture and project that:

> not only could the result be the propagation of genetically superior trees, but the flurometer work should greatly enhance the chances of using stock of good quality for outplanting, thereby increasing survival in the field. If the overall survival rate (now as low as 33 per cent in some areas) can be improved by a mere 10 per cent, the payoff could exceed 10 million dollars annually (1987,13).

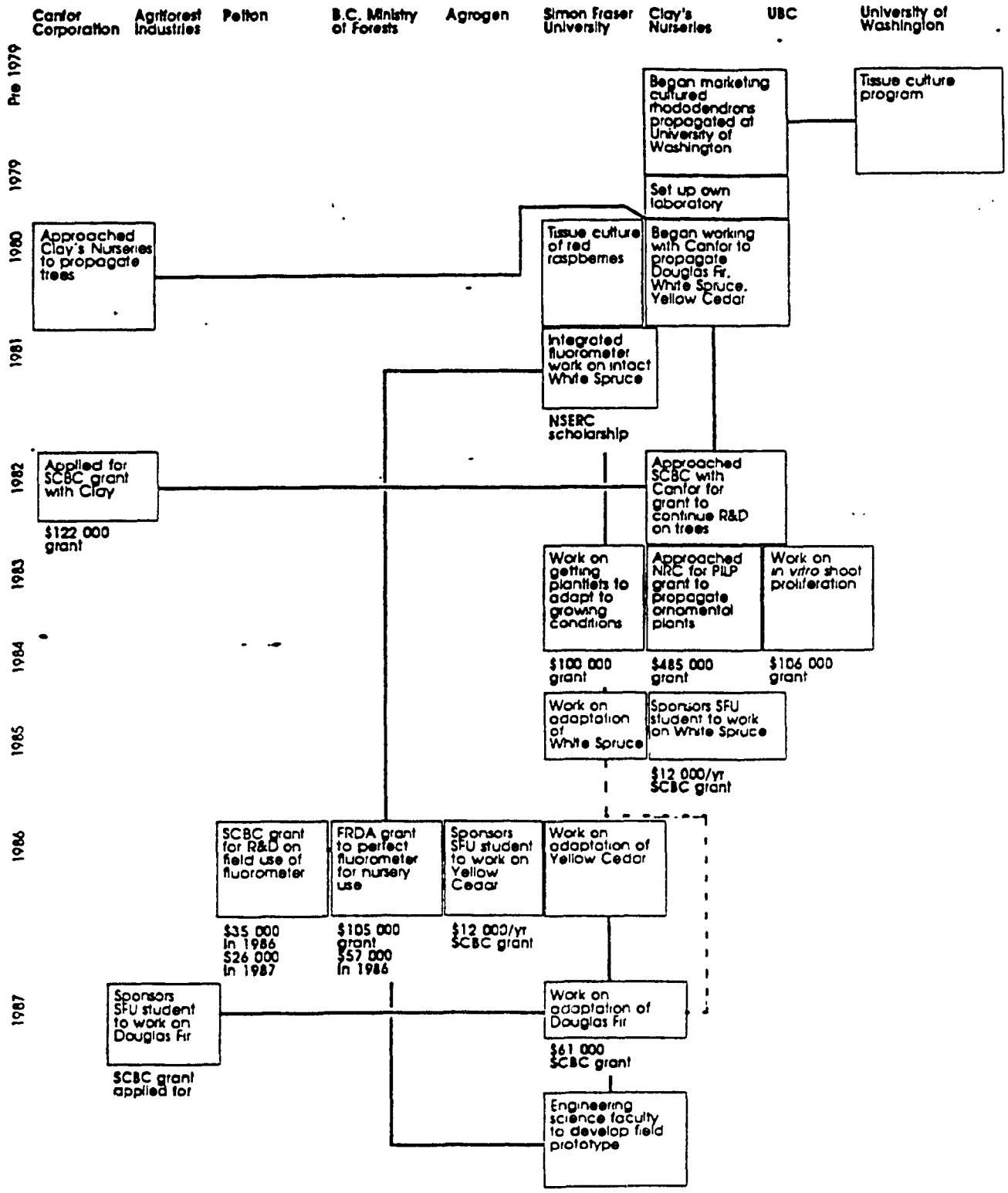
The success of this university-industry research project can be attributed to largely three factors, as outlined by the Council. First, and foremost, is the commitment of the overall 'supervisor', Dr. Vidaver. Second, the effective communication between all of the parties involved but, particularly between the relevant university personnal and Clay Nurseries. And, third, the manageable size and complementary nature of each of the individual projects that evolved after the initial 1983 linkage. All of the participants were able to pursue individual objectives but, at the same time, the common goal of superior tree quality with greater yields was never put aside.

The University of Calgary linked with Willowglen Systems Ltd. officially in 1986 to:

> develop software to control continuous flow-production processes. In the trade, this type of software is known as SCADA (supervisory, control and data acquisition). SCADA systems are particularly useful in the oil and gas industry but are also used in a wide range of other plants and processes (Science Council

Figure 2.2

Links between Simon Fraser University, Clay's Nurseries and other partners



Source: "R&D Links Between Firms and Universities: Six Case Studies". Science Council of Canada. Discussion Paper. (1987) pp.10.

of Canada,1987,14).

A group of 27 scientists and engineers, consisting of University of Calgary faculty specializing in electrical engineering and computing, formed a unit called SRDG (software research and development group) to work on the SCADA package with Willowglen.

Willowglen envisioned an increase in its 10 million dollar revenues to 100 million dollars within five years if the software package JADE, a creation of the University of Calgary's SRDG unit, could be developed into a viable distributed system for plant and process control. However, such an SCADA application would require considerable technical expertise, highlighting the rationale behind Willowglen's desire to work with the university.

> After months of difficult negotiations, the University of Calgary and Willowglen Systems Ltd. contracted to carry out this ambitious research and development project for a real-time distributive software base and the SCADA application (JADE) using the base (Science Council of Canada,1987,15).

The financing for the project, which has a total current budget of 1.4 million dollars, came from two sources: Willowglen directly and from the National Research Council under its Research and Development Policy (IRAP) which approved a 460 000 dollar grant application.

The major obstacle that had to be overcome during the negotiation process was the question of overhead costs. The university, as was their prevailing policy for contract research, wanted to charge 100 per cent of these costs to Willowglen; a cost which proved to be too great for Willowglen to incur. Thus, an alternative scheme was agreed upon. Essentially, a joint-venture was formed.

> Under the arrangement, Willowglen reimburses a significantly smaller part of the overhead costs (25 per cent) but must share the rights to other application developments on the base system software (Science Council of Canada,1987,15).

Both Willowglen and the university had, in effect, risked resources in the anticipation of mutual

benefits and it is this flexibility that kept the link intact.

Should the project achieve its objectives, Willowglen stands to benefit massively through increased revenue and the University of Calgary, specifically the SRDG group, will become established as a centre of technical expertise and a real-life advertisement for the capabilities of technology transfer.

Thus, consultantships and affiliate-type programs do exist in Canada. It appears that university-industry relationships are not only an ideal way for a nation's industry to stay competitive with the universal technology race, as universities take on the role of the growth-pole, but to also act as a catalyst for regional development. Connor, Wiley and Young (1986), however, warn that these linkages between industry and institutions of higher education can have their drawbacks if left unregulated. These authors, in their paper "Acedemic-Industry Liaison in the United Kingdom: Economic Perspectives", temper the prevailing attitude, emerging in the British literature, of never-ending benefits accruing from university-industry linkages.

As both the Simon Fraser University and University of Calgary examples revealed, the private sector can with relative ease receive government funding for university-collaborative endeavours. Connor, Wiley and Young see this situation as an opportunity for industry to misuse the public's funds by only marginally pursuing innovative activities in return for financial backing.

> A system in which liaison activities were purely commercially-funded would be likely to give rise to underprovision of services which yielded 'general payoffs' rather than those specific to individual companies, and which were oriented towards discovery rather than towards the routine application of known techniques (Connor,Wiley and Young,1986,412).

The attainment of government funding may too often be the underlying motive of an industry seeking to merge research interests with a university.

Similarly, again if financial subsidization is too readily available, professors and other professionals acting in an advisory role to industry may devote too much time on such activities at

the expense of their academic, and more immediate, obligations. In this context, the major dangers of industrial over-involvement include:

> misdirection and reduction in both teaching and research effort in favour of massive consulting with corporations or lengthy forays into entrepeneurship; restrictions on the publication of research findings, to maintain a competitive advantage that could be worth large sums of money; and a loss of a reputation for 'disinterested' inquiry. Such problems are acknowledged not simply by those in senior management, but by those who are themselves active in liaison (Connor,Wiley and Young,1986,408).

Thus, a system in which funds are freely allocated to various university-industry liaisons produces a society which is not optimally utilizing the resources of either institution. Connor, Wiley and Young believe that 'subsidized benefits' for industry to exploit through technology transfer with universities and the possible pre-occupation of university faculty with industrial matters must be guarded against. But, the authors concede that if university-industry relationships are regulated, undoubtedly implying some type of government involvement, then the benefits can continue to be extraordinary.

CHAPTER 3 - THE UNIVERSITY AND ITS LOCAL INFLUENCE

(A MICRO VIEW)

The previous chapter established that universities have been used as instruments for regional development and that the attraction of high-tech activity to them appears to be paramount in achieving some higher level of prosperity within a university's area of influence - this, however, is only part of the story. The emphasis of this chapter is to explain how this is done by outlining the direct and indirect effects a university can have on its community/city/region.

3.1) Direct Effects

Simply stated, the only critical distinction between economic and non-economic impacts of the university institution upon its respective area of effect is that the economic impacts must necessarily be quantifiably estimated and non-economic benefits are only realized in a qualified fashion.

3.1.1) Economic Impacts

When considering the economic impacts of a university, or any other single establishment of influence for that matter, inevitably the analysis will take some form of 'impact study'. But, as John Caffrey and Herbert Isaacs exclaim in their publication Estimating the Impact of a College or University on the Local Economy: "these (impact) studies are usually designed as unique research projects to meet ad hoc local needs" (1971,3). Such a situation allows for little cross-comparison among university studies due to a lack of regularity in the way the research methodology is carried out. To combat this problem, Caffey and Isaacs have provided a standardized approach which subsequent impact studies have tended to, with a good degree of

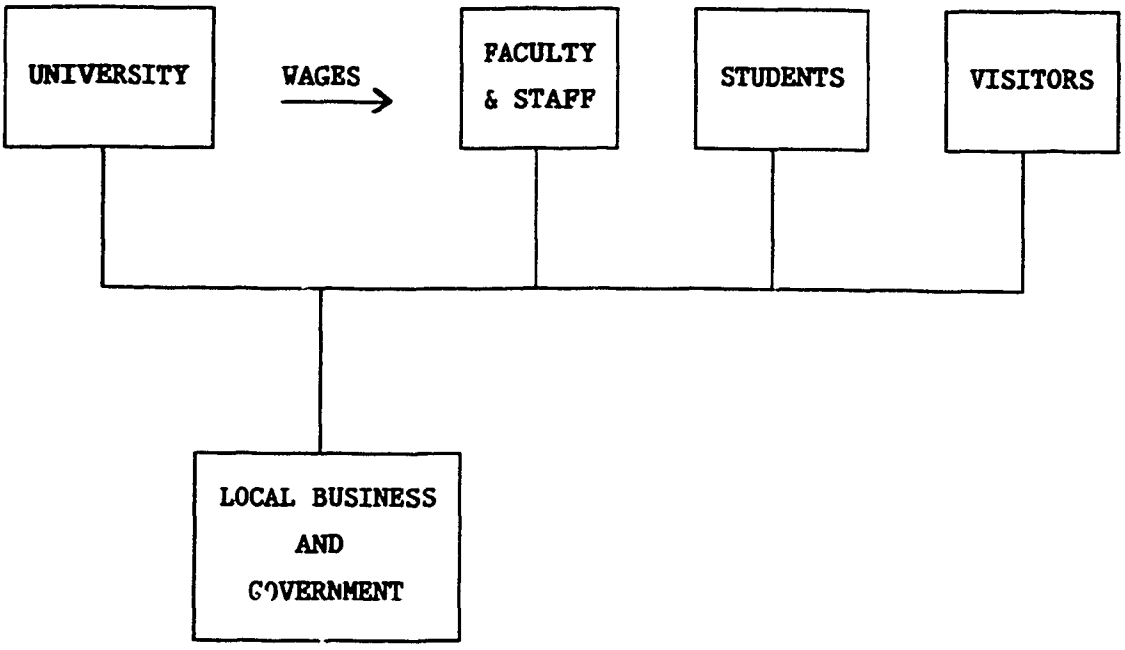
rigidity, follow. Thus, for this reason, the major points of this important publication will be summarized.

Essentially, these American authors provide a series of applicable models which are "linear cash-flow formulas, and include only what can be readily counted or added and omit the inclusion of qualitative issues" (Caffrey and Isaacs,1971,4). They break up the total economic effect of universities into three broad groups: the impact on business, government and individuals and generally attempt to establish where the wealth is flowing. Figure 3.1 shows the simpliest version of the author's conceptual cash-flow relationship. Listed are the four general sources of expenditure which effect local business and government in varying degrees: from the university directly, from the faculty and staff, from the students, and from the visitors to the university. It is with respect to these criteria that the necessary models are formulated to estimate both local and non-local expenditure and, therefore, community wealth that is created directly by the university.

Caffrey and Isaacs go on to develop more complicated models equipped to estimate the university's effect on an individual's personal income and employment potential; and, as with all of the derived cash-flow equations, the authors illustrate how these models are developed, their assumptions and limitations, and in what context to successfully utilize them. It should be realized that although the community will typically experience added 'revenues' from the local presence of a university 'expenses' are, never-the-less, part of the total picture. For instance, universities often benefit from being on tax-exempt land which would otherwise be occupied by a tax-paying resident. These so-called 'expenses' of local universities are included as well in the more elaborate cash-flow models.

At any rate, one could freely view this publication as a general 'how-to' guide for evaluating the economic-side of a specific university's community impact. As such, Caffrey and Isaacs stress that these procedures purposefully omit the assessment of non-economic (non-quantifiable) issues

Figure 3.1



Source: Adapted From Estimating the Impact of A College Or University On the Local Economy, by J. Caffrey and H. Isaacs, American Council of Education (1971) pp. 5.

because of the excessive degree of subjectivity inherent to such endeavours. However, this certainly does not reduce the usefulness of this publication. Caffrey and Isaacs' methodology has definitely set a precedence in which future economic impact studies have tended to follow exclusively; including, most recently, studies concerning the universities in Edmonton, Calgary, Toronto and Kingston as well as several notable higher education institutions in the United States (Found,1988,28).

It probably goes without saying that university impact studies are not just limited only to the North American experience. As was witnessed, the university-oriented strategies outlined in Chapter 2 for various Scandanavian destinations, although not specific impact studies, can never-the-less be considered as 'checks' on the usefulness of the implemented policies. Similarly, many academics in the United Kingdom have closely monitored the influence of higher education facilities with respect to educational and regional matters. One such study, Exeter University and City by F. Lewes and A. Kirkness (1973) examplifies quite nicely the type of economic impact studies pursued within a British setting.

With a 1972 population of 96 000 people, Exeter is not considered to be a particularly big city. And with the 3 682 students registered at the University of Exeter in 1972, a fairly conservative student to population ratio of 39 per thousand is formed. Lewes and Kirkness, however, stress that it is the nature of Exeter's economy that makes it far more vulnerable to the impact of the local university than would other cities with a far greater student/population ratio.

> The economy of Exeter is unusual in the extent to which it relies upon the distributive trades, and lacks substantial manufacturing industry (Lewes and Kirkness,1973,71).

It is this lack of manufacturing emphasis that has led the authors to conclude that local income and employment will rely increasingly more on the university to stimulate, particularly, the service sector. In fact, it is projected that once the university reaches a level of 10 000 students,

11 to 13 per cent of the local economy will be directly or indirectly connected to university-related activity.

Lewes and Kirkness admit that there are innumberable ways in which a university can and does effect the area around it but they isolate these factors into four general topics: the financial or monetary flows, the employment situation, the accomodation and traffic dilemmas and, finally, the more personal connections between the university and its surroundings. There is a striking resemblence between this study and the methodology developed by Caffrey and Isaacs. Monetary flows, employment calculations, and the effect on accomodations are all addressed through the models formulated by Caffrey and Isaacs. As well, the so-called 'more personal connections' such as acedemic linkages between faculty and industry, are discussed by both sets of authors but not quantified in any fashion. Therefore, with the exception of Exeter's apparent traffic conjestion problems, all of the university-related impacts were, seemingly coincidentally, already previously modelled by the American writers.

At any rate, economic impact studies on either side of the Atlantic seem to address similar types of criteria. When considering both the Exeter and the Princeton (found in Caffrey and Isaacs' appendix) applications; it becomes apparent that the students themselves are unambigously the most critical component of effect upon the community. The massive influx of students into a university region translates into an immediate increase in community spending. Wages paid to faculty and university staff also result in important local expenditure as well. The direct spending of the university itself can be substantial especially in periods of campus construction. The attraction of business into the area was cited as ranging from moderate (in Exeter) to extremely high (in Princeton). However, neither study attempted to quantify this effect. Housing dilemmas, concerning rising rents and housing shortages, seem to be common in university communities. However, the fact that universities are usually perceived as 'tax-exempt' and therefore an indirect

drain on municipal funds appears to be an over-rated drawback. This is particularly evident in the Princeton scenario where the vast majority of the land occupied is, in fact, taxable (only acedemic buildings, dining halls and dormatories are exempt).

3.1.2) Non-Economic Impacts

There are those (Lynton and Elman,1987,1) who would claim that any economic-type value a university may achieve is largely irrelevent when its only true attributes concern benefits which are necessarily non-economic in nature; particularly, the creation and advancement of knowledge. And, although this view may be considered a bit narrow in judgement, the transfer of knowledge does remain a university's top priority.

> Knowledge, and particularly advanced knowledge, constitutes the essence of universities. They are the societal institutions with the specific responsibility to create advanced knowledge, interpret it, and disseminate it. Hence, as the role of knowledge in society changes, universities need to respond accordingly. The task remains the same: to be the prime source of intellectual development for society (Lynton and Elman,1987,1).

Therefore, a university's most critical non-economic impact, and admittedly its most vital role period, is its transfer of theoretical and practical intellect to its respective students; a point which needs no further be-labouring as long as the emphasis of this statement is understood.

Apart from the attributes resulting from the transfer of knowledge; the students, faculty and the university itself can still benefit their surroundings directly in a purely non-economic fashion. The university can act as a 'community leader' and provide a service to municipalities which do not have the financial or political resources to respond to community problems directly. Such a situation is outlined by Howard Mitchell (1974) in his book The University and the Urban Crisis; in which the second chapter is devoted to describing "The Human Resource Centre of the University of Pennsylvania". Here a university-based unit, comprised of faculty, students and

relevent community representatives became a 'think-tank' for social problems confronting the immediate university region. This scenario is an excellent example of university-community collaboration in efforts to improve the prevailing conditions in a fundamentally non-economic fashion; and for this reason some of the details will be shared.

The city of Philadelphia and the University of Pennsylvania have always been tightly intertwined. Mitchell reflects upon a nine year experience (1964-1973) when he headed a university-based comprehensive community program called the "Human Resource Centre" (HRC). This involvement, he claims, has proven to compliment both the city and the university's positive progression. The program was conceived as a response to Philadelphia's sometimes violent upheavals between socio-economic and racial groups.

> Philadelphia today still struggles to understand and develop ways of bridging the gap between the affluent and the impoverished, the educated and the under-educated, the employed and the unemployed, the sheltered and the homeless... (Mitchell,1974,36).

Hence, in efforts to better understand and to eventually more adequately deal with these conditions, the Human Resource Centre was set up in 1964 to: firstly, participate in reversing the city's slide into further urban decline and, secondly, to seek the proper means to prevent a widening of the well-being disparity gap and resulting social tensions.

The HRC was actually formed out of the "University City" project (1959) in which city authorities, business, industry, the university and community groups combined to create a centre for scientific research aimed at combating Philadelphia's growing urban problems. It was not long before the students themselves became interested in 'doing something for the poor people around them' and accordingly more of the project became centred around the university. The University City project transformed into the more campus-oriented HRC which, among other things, allowed for the imput of faculty to become more pronounced.

The university in a sense became a therapist for the community and sought to examine such problems as: illiteracy, racism in housing and loan application settings, crime, police-community conflicts, high-school 'drop-outs', reduction in higher education enrolment, inadequate utilities, alcohol and drug addiction, workplace discrimination (both sexual and racial), lack of playgrounds and many other urban-related drawbacks. To combat these dilemmas, the HRC set up numerous workshops, courses and personal counselling sessions (often faculty and/or student headed) for the city's disadvantaged and other relevent parties to partake in.

Mitchell outlines several immediate benefits which have already occurred in this long process of social correction. Both graduate and under-graduate students, particularly in psychology, law, social work, education, medicine and urban planning; involved with the HRC's program implementation have been credited with clinical experience counting directly towards their degrees and immeasurably towards their future professions. But, far more significant has been the city's 'have-nots' acceptance of the university as an equalizing and advantageous institution and not as an impenetrable domain for the elite in society. This change in the public's perception is clearly seen in the increased willingness of the 'troubled groups' in the community to bring their concerns to the HRC, creating the first step in the problem solving process.

It should be noted that although this Philadelphia-University of Pennsylvania linkage was set up to combat various social problems and that some success in this regard has been realized, the idea of a university growth-pole remains well intact. The only difference between this Philadelphia situation and the other university-regional development schemes outlined earlier is that here the university is a social, rather than an economic, growth-pole. By better educating the populace; reducing crime, drug-related problems and racial tensions; and generally improving the social environment, society as whole becomes more productive. Accordingly, a more productive community that is less inhibited by social tensions will become a more prosperous and wealthy

one as well. So, essentially, whether the university in question acts as a social or economic growth-pole, the overall effect on its area of influence is the same: the immediate population's level of well-being is improved and, at the same time, a greater balance among socio-economic classes is achieved.

3.1.3) York University's 'Total' Impact

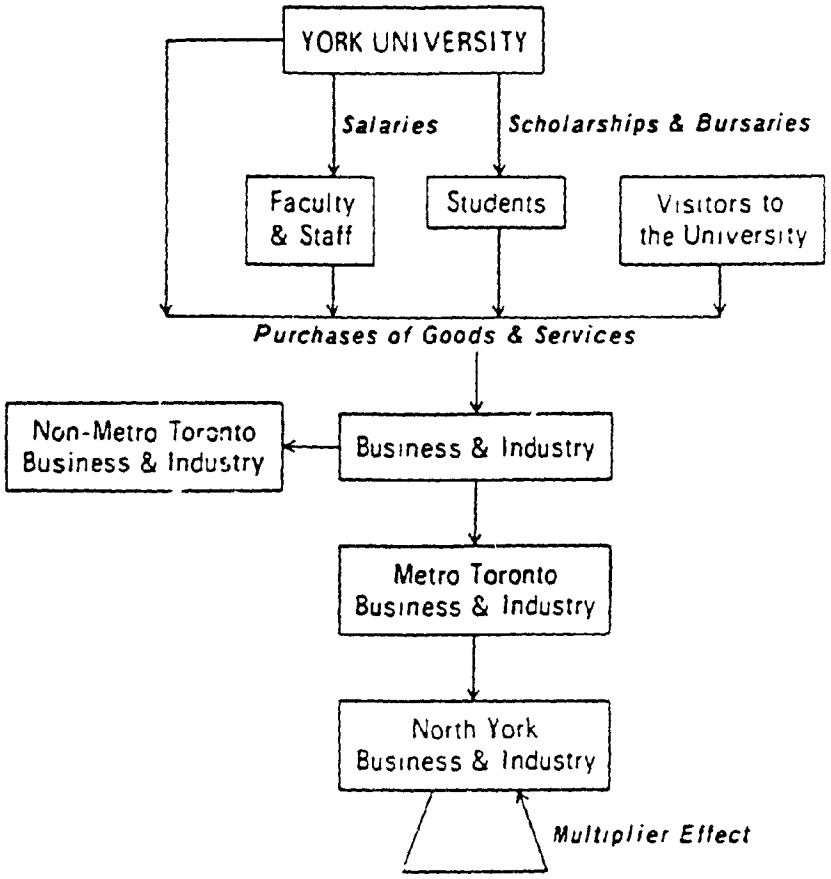
In order to get a contemporary view of how a university can directly effect its surroundings, the work of Dr. William Found (1988) and his study The Impact of York University on the City of North York 1987-88 will be presented. The reason for including this illustration relates to the comprehensiveness of the study. In fact, Found has attempted to consider in detail both economic and non-economic impacts and the extent of these effects in both local and non-local terms. To avoid repetition with the previous sections, only the results of York's impact , especially those which have not yet been discussed, will be summarized.

Like many other impact studies, Found based the economic-side of York's effect on Caffrey and Isaacs' methodology (as Figure 3.2 conceptually shows). Here, the university's expenditure-flow effect is illustrated in the form of purchases of goods and services from various sources of contribution upon the local and non-local business and industry. Table 3.1 takes this conceptual model and simply puts numerical values to the criteria listed. Essentially, Table 3.1 estimates the one year direct economic impact of York University on three scales: in total, for Metropolitan Toronto, and for the city of North York.

The author admits that the estimation of the values listed on the table . calculated very conservatively; only effects which could faithfully be accounted for were included in York's direct economic influence. Obviously, many of the dollars spent in the form of goods and services go undetected by this or any other survey, making any study of this nature subject to criticism but

Figure 3.2

SIMPLIFIED UNIVERSITY EXPENDITURE-FLOW MODEL
USED IN THIS STUDY



Source: Estimating the Impact of a College or University On the Local Economy. J. Caffrey and H. Isaacs. American Council on Education. (1971) pp.6.

by no means valueless. And, once it is displayed how Found arrives at his estimates, it should be clear as to why this tends to be the case.

The personal expenditures of York faculty and staff are calculated as York salaries minus the mandatory deductions (pension funds, UIC, and so on). It is then assumed that this net-value is spent exclusively within the municipality where York faculty and staff reside. Also, Found reasons, that any personal savings will ultimately resurface in the local economy and, therefore, any portion of salaries invested is in effect irrelevant. Thus, the contribution of York faculty and staff to the total economy, Metropolitan Toronto (a subset of the total), and the city of North York (a further subset) are calculated as such and shown on Table 3.1.

The estimation of students' contributions turns out to be even more conservative. In that, the only purchases that Found could concretely recover for, firstly, students who live at home was the purchase of their books and, secondly, for students who took local residency specifically to attend York University, was the purchase of books and the value of rent paid. Of course, students would have countless other reasons to purchase goods and services in North York or beyond but, in defense of Found, how would these seemingly endless transactions be discovered?

The direct university expenditure pertains to all the purchases made by the university directly for 1987-88. The author recovered these figures by tracking down the destinations of all York payments through postal mailing codes. The 'visitors to the university' category (such as parents, guest speakers and the like) is a value estimated as 1 per cent of the total student, faculty, and staff expenditure; a procedure which Found explains is common to typical university impact studies.

Therefore, the total economic value from all of the sources of expenditure contribution is roughly 231 million dollars. Yet, this does not represent the total economic impact on the economy; money is regenerated and in effect multiplied to have a far greater effect than merely the initial expenditure. Found uses an economic multiplier of 1.7, apparently as an approximation

Table 3.1

SHORT-TERM, DIRECT ECONOMIC IMPACT OF YORK UNIVERSITY: TOTAL, METROPOLITAN TORONTO, AND CITY OF NORTH YORK; BY SOURCE OF CONTRIBUTION; 1987-88

SOURCE OF CONTRIBUTION	TOTAL IMPACT ($)	METRO TORONTO ($)	CITY OF NORTH YORK ($)
Faculty (Full-Time)	47,450,689	35,893,142	20,921,029
Other Employees	53,533,356	38,114,239	20,659,346
Students	41,353,030	33,367,984	28,525,710
Direct University Expenditures	86,672,267	60,137,207	18,308,611
Visitors to the University	1,428,371	1,073,754	701,061
TOTAL	$ 230,937,700	$ 168,586,310	$ 89,115,757
Economic Multiplier	1.7	1.7	1.7
TOTAL SHORT-TERM ECONOMIC IMPACT	$ 392,594,090	$ 286,596,720	$ 151,496,780

Source: The Impact of York University On the City of North York 1987-88, W.C. Found, York University, (1988) pp. 29.

of other similar North American studies with multipliers that ranged from 1.5 to 2.0, and from there finally derives the total short-term economic impact for his three regional subsets.

Now, it should be explained that by stressing the conservativeness of these estimates is by no means to devalue Found's survey. Rather, it is to emphasize the magnitude of York's immediate economic impact, which is at the very least nearly 400 million dollars for one year. And, as the assumptions suggest and as Found concludes, the actual economic impact could well be three to five times what has been calculated.

It should also be noted that the multiplier of 1.7 can also be applied to York University's total labour force of 4041 and an estimate of 6870 is derived. Which is to say that 6870 full and part-time jobs were to have been, in approximate terms, created within the community via the university.

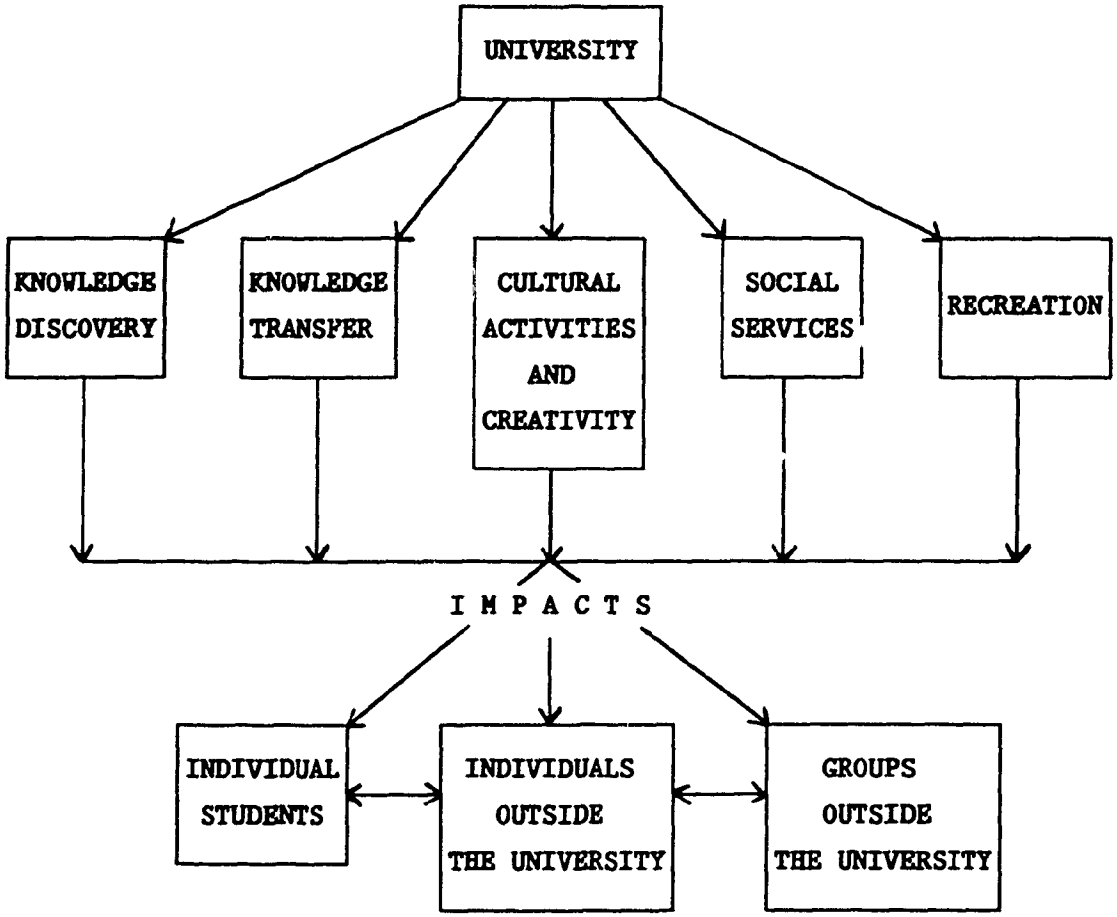
To Dr. Found's credit is the inclusion of a section featuring the non-economic benefits accruing from York University. The model (Figure 3.3) shows how a university can influence the students, various individuals, and groups external to the university in a purely non-economic fashion. By using this framework, Found went on, through a series of interviews, to look at the many non-economic community impacts that the university is potentially having on North York; some of which will be summarized below.

York's most vital attribute is its ability to transfer knowledge to its students, predominately through its 4600 courses, and to the community at large where non-credit courses are offered to over 4000 people per year. The instructors themselves are more than adequately qualified to teach; many have distinquished international standings. Yet, Found sees their extra-curricular efforts towards community-oriented activities as being equally impressive.

For instance, many professors head workshops aimed at helping students and local citizens become more computer familiar. Other members of the faculty tutor foreign residents in grasping

Figure 3.3

A MODEL OF THE NON-ECONOMIC IMPACTS OF A UNIVERSITY



Source: The Impact of York University On the City of North York 1987-88, W.C. Found, York University, (1988) pp. 30.

the English language. Still others instruct non-credit courses in Accounting, Marketing, Personnel Management, Real Estate, and Woman's Studies which are open to the entire community. The faculty in many of the university's departments also run various 'shows' for the public including the Science Olympics (a contest for high-school students), art and theatre displays, a wide-range of cultural events, and astronomy showcases. Not only do these events provide the non-university population with an informal medium for learning, but adds to increase inter-action and public awareness of what a university can provide beyond student education.

The on-campus libraries do, of course, contain a massive source of knowledge exploitable by both students and citizens alike. And, according to Found, virtually every working day North York residents have the opportunity to attend special seminars, conferences, or major addresses on one of the York campuses.

When one considers these and other student-run community services (such as recreational and sporting programs, a legal aid clinic, and summer camp affiliations) it becomes clear, in immeasurably beneficial terms, the great value York University has on its surroundings in non-economic terms. Indeed, the university is a growth-pole that greatly contributes to community well-being. Not only is it a major generator of regional wealth but adds abundantly to the city's quality of life.

Thus, Found's impact study provided a very adequate example of the direct economic and non-economic impacts an institute of higher education can have within and beyond the local community and, therefore, fit into this discussion quite well. To follow, are the indirect, and less immediate, influences of universities upon their socio-economic environment.

3.2) INDIRECT EFFECTS

Thus, with many of the direct effects of universities summarized, it now seems appropriate to

explore the indirect effects that these institutions can have on a region's immediate level of well-being. Specifically, two criteria: high-tech industry and trained graduates, which through a definite inter-action with the university, can in turn greatly influence a region in socio-economic terms. The university by training, motivating, and directing its students creates an on-going outflow of workers which typically evolve to become the elite in society. Areas which are relatively rich in trained university graduates tend to economically out-perform other destinations. Similarly, the university's ability to attract high-tech industry, today's 'motor' for the economy, usually accrues in benefits for the respective area as well. The balance of this chapter will go on to show how trained graduates and high-tech industry directly, and as a result the university indirectly, participate in regional prosperity.

3.2.1) The Value of Graduates

There does appear to be a positive correlation between education and income; a relationship that has been well-documented. Seymour Harris (1947) was one of the first to recognize this empirical regularity and stated that "whatever be the future effects of education on income, it appears it has paid so far" (Harris,1947,34). Since Harris' time, this notion has remained rigidly intact:

> A person's earning power is positively associated with the years of schooling completed. Higher levels of educational attainment usually go hand in hand with more secure and better-paying jobs. In 1983, for example, the incidence of poverty among people with only elementary schooling (19.9 per cent) was almost four times as for those with a university degree (5.2 per cent) (Courchene and Melvin,1987,277).

Seldom has as strong a statement been made in favour of a good education; a university degree seems to drastically reduce the possibility of personal economic misfortune. Relatedly, then, regions possessing these 'prosperous' graduates must enjoy some comparative advantage (through larger local expenditure, more investment, and a higher taxable income) over regions not rich in

highly educated people.

Cousineau and Vaillancourt (1987) recognize this relationship between income earning potential and the level of schooling. Provinces with superior levels of average annual employment income generally possess a population that features an accordingly longer duration of average schooling as well (see Table 3.2). In a more detailed display, Table 3.3 breaks down the years of education into categories and as the authors conclude: "the relationship between income and education may be seen to be a direct one in the case of each province" (Cousineau and Vaillancourt,1987, 361).

The results of this discussion caused the authors to call for reforms to the educational system in the direction of a more equal distribution of university graduates. Areas of particular concern, as the tables suggest, are the Maritimes, Saskatchewan and Manitoba. Graduates, because of their higher inclination to gain and distribute wealth, are in themselves agents of regional development. However, simply improving educational facilities in depressed Canadian destinations will not necessarily raise the level of local graduates. Table 3.4 clearly illustrates the mobility of newly trained people and, unfortunately, their pattern of migration tends to be away from the provinces where they are most needed.

Therefore, Cousineau and Vaillancourt's study nicely illustrates the long-suspected correlation between income and education and the related link between graduates and regional prosperity. Yet, the latter relationship, although conceptually sound, is spatially inconsistant. Which is to say that a university in Newfoundland, for example, may well be training a workforce that will better fit the requirements of occupations in Ontario or Alberta and do little to benefit the domestic economy. So, universities, via their graduates, provide an essential indirect service to the economic environment, but the positive effects might not be felt locally.

3.2.2) High-Technology and Regional Prosperity

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3.2.2) High-Technology and Regional Prosperity

Table 3.2

EMPLOYMENT INCOME AND AVERAGE EDUCATIONAL LEVEL: MALES, NINE PROVINCES, 1980-1981

PROVINCES	AVERAGE ANNUAL EMPLOYMENT INCOME	AVERAGE YEARS OF EDUCATION*
Alberta	16,435	11.7
British Columbia	15,292	11.7
Ontario	14,505	11.3
Quebec	13,200	10.5
Saskatchewan	12,853	10.5
Manitoba	12,153	10.7
Nova Scotia	10,470	10.5
New Brunswick	10,230	10.1
Newfoundland	9,996	9.8

Source: "Investment In University Education, Regional Income Disparities and Regional Development", J. Cousineau and F. Vaillancourt. In Still Living Together: Recent Trends and Future Directions in Canadian Regional Development, Edited by W. Coffey and M. Polese, (1987) pp. 362.

Table 3.3

AVERAGE INCOME BY LEVEL OF EDUCATION: MALES, NINE PROVINCES, 1980

	PRIMARY		SECONDARY		POST-SECONDARY		
PROVINCES	1-4	5-8	9-10	11-13	1-2	3-4	5 +
Newfoundland	9,476	10,174	10,519	14,176	15,649	17,661	25,650
Nova Scotia	10,237	11,218	12,070	13,840	16,143	17,364	25,885
New Brunswick	9,701	10,642	11,831	14,186	14,895	18,076	24,984
Quebec	12,782	14,247	14,254	15,387	19,060	24,427	32,590
Ontario	14,495	15,254	14,740	16,499	18,646	24,003	30,554
Manitoba	8,811	12,400	12,773	15,334	16,349	20,176	27,183
Saskatchewan	9,407	14,256	14,594	15,639	17,628	21,671	28,484
Alberta	13,928	16,155	15,946	18,414	18,996	24,800	31,007
British Columbia	15,169	17,095	16,626	18,420	19,428	21,442	29,336

Source: See Table 3.2 (pp. 363)

Table 3.4

NET MIGRATION OF YOUNG DEGREE HOLDERS, 1976-1981

PROVINCES	(1) IN-MIGRANTS	(2) OUT-MIGRANTS	(3) NET MIGRATION	(4) PERCENTAGE OF GROSS FLOWS
Newfoundland	300	450	-150	-20.0%
Nova Scotia	1,500	2,050	-550	-15.5%
New Brunswick	1,100	1,700	-600	-21.4%
Quebec	2,650	5,400	-2,750	-34.2%
Ontario	5,800	10,050	-4,250	-26.8%
Manitoba	1,300	2,350	-1,050	-28.8%
Saskatchewan	1,200	1,450	-250	-9.4%
Alberta	9,200	2,450	+6,750	+57.9%
British Columbia	5,050	2,200	+2,850	+39.3%

Source: See Table 3.2 (pp. 370).

Another indirect effect of universities which, in comparison to the effect of graduates, is usually more locally felt relates to regional prosperity through high-technology activity. Admittedly, technology in general has effected today's society in a massive and almost unaccountable array of subtle and not so subtle impacts. However, the focus here will be restricted to discovering how 'state-of-the-art' firms, presumably drawn by the presence of a university, act to stimulate regional development.

Defining what exactly a high-tech firm is and what sets it apart from other forms of industry is not an easily accomplished task and depending on the publication consulted, ideas on this topic vary noticeably. Yet, for the purposes of this analysis, those industries specializing in Robotics, Telecommunications, Computers, and Semiconductors will be loosely considered as comprising the high-tech environment (Paul,1984,2). Yet, if further qualifications are sought Larson and Rogers characterize a high-tech industry by:

> (1) highly educated employees, many of whom are scientists or engineers, (2) a rapid rate of technological innovation, (3) a high ratio of research and development expenditures to sales (typically about 1:10), and (4) a worldwide market for its products (1987,100).

Generally, then, industries which are particularly high-tech are those which are 'progressively modern' in terms of the elite they hire, the products they sell, and the effect these products have on advancing society.

Thus, definitions aside, the success of this argument hinges on the assumption that universities can attract high-tech industry into the vacinity to subsequently, among other things, develop the region. It may be useful to detail this apparent compatibility between the two institutions a little more closely. Markusen, Hall, and Glasmeier (1986), through an extensive literature review, summarize the various qualities in an area that will induce high-technology industry settlement (shown in Figure 3.4). Given the nature of high-tech industry, none of the eleven attractions listed

Figure 3.4

HIGH-TECH INDUSTRY IS ATTRACTED TO:

1. major airports with good national and international passenger and air cargo activities
2. areas with good natural amenities, in particular mild and sunny climates
3. areas offering attractive housing at reasonable prices
4. areas with educational and cultural advantages, including good educational opportunities, an array of specialized cultural services, low levels of pollution and good recreational opportunities
5. regions which are weakly unionized, and have low wage rates and high unemployment rates
6. areas with a high degree of internal accessibility and connectivity as for instance areas with well-developed highway systems
7. areas with a well-established infrastructure of specialized business services
8. places which have an anti-regulatory, free-enterprise ideology
9. centres of industrial R&D which will tend to locate close to the headquarters of major industrial corporations
10. locations with concentrations of federally funded fundamental scientific research
11. areas with high concentrations of defense spending

Source: High Tech America, by Markusen, Hall, Glasmeier (1986), pp. 133-142.

are particularly surprising or hard to understand. What captures the interest is how explicitly university involvement comes across in the criteria. With the exception of the third listing on Figure 3.4, which pertains to low house prices, all of the regional attributes deemed to attract high-tech industry are either equally suitable for university settlement, or typical of an already existing university-influenced community. Therefore, the co-existence of both university and high-tech industry in an immediate area is not only a real occurrence, as was previously outlined, but conceptually comprehensible as well.

The common opinion has been to view high-technology as the next engine for regional development, "the cornerstone of the new information society, and the means whereby some peripheral regions could gain comparative advantage within the national urban system" (Lamarche,1986,343). Ideally, a convergence of well-being, via a trend towards an equalization in employment and income levels, between major and peripheral communities will occur as technological activities become more pronounced in hinterland settings. However, as Lamarche quite accurately points out, "just as isolated establishments failed to become growth-poles, isolated high-tech firms can not be expected to generate a complete turnaround of a region's economy" (1986,342). Yet, when high-tech firms are clustered together to form so-called 'research centres', the effects on less developed areas become more visible.

Undoubtedly, the three most publicized and successful applications of the research centre as it applies to regional development are Silicon Valley, Route 128, and the North Carolina Research Triangle situations. Nijkamp and Mouwen provide a condensed overview of these three situations, and are careful to emphasize the university influence in each case.

> Silicon Valley as an offspring of the Stanford (university) Industrial Park is the classical example of an integrated, rapidly-growing knowledge centre based on advanced computer and telecommunication technology. Its commercial basis, its position as the nucleus of a communication network and its efficient organizational struture shaped the conditions for a successful regional development pole. Route 128 in the greater Boston area induced by military and

> aircraft R&D expenditures and later by many high-tech firms, is a clear spin-off effect of the Boston-Cambridge scientific climate. Its continued success has been mainly due to the innovation potential in this area which was created by its favourable sectoral structure, its diversified labour market and its efficient institutional structure. The Research Triangle of North Carolina may be regarded as a spin-off result of the universities of Releigh, Durham, and Chapel Hill. It started as a purely academic research area, but later it also encompassed new production activities. The presence of acedemic research institutes and the favourable social climate were mainly responsible for the success of this knowledge centre (1987,259-260)

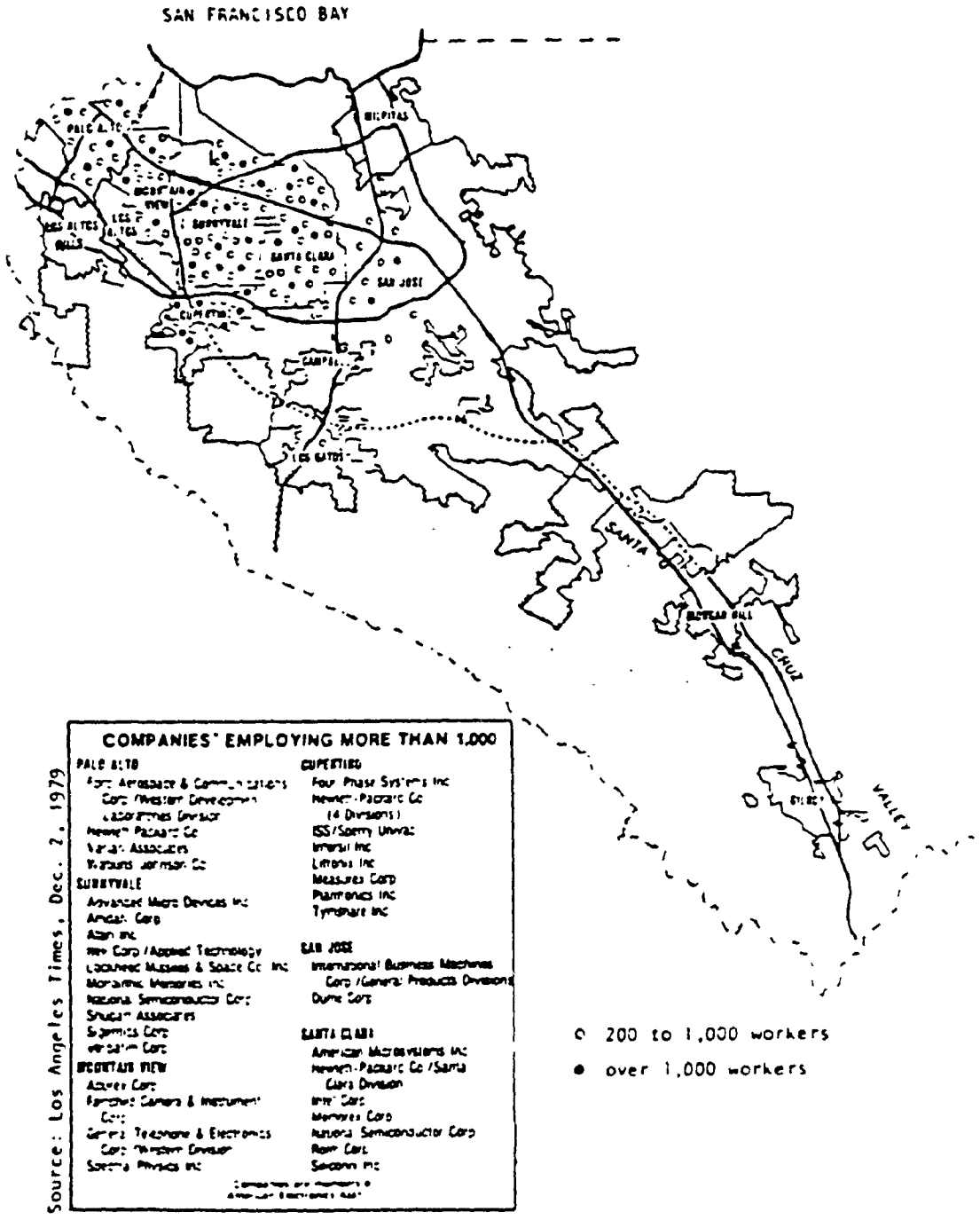
All three of these high-tech havens have had considerable influence on their respective surroundings. The Silicon Valley and Route 128 situations will be detailed within this regard below. (The effect of the Research Triangle on some of the cities of North Carolina was discussed in Chapter 2's literature review).

Silicon Valley has been dubbed the world's capital of the information society. Since the 1940's, its overwhelming entrepreneurial spirit, largely directed towards semiconductor and microcomputer activities, has brought immense wealth and employment opportunities into North California and specifically into Santa Clara and adjacent counties (see Figure 3.5). Stanford University provided the focal point for innovation and new firm start-ups in Santa Clara County during the 1950's and 1960's and when the market for microelectronics boomed roughly a decade later, so did the region's economy (Saxenian,1985,82).

The area attracted a large proportion of professions (by 1970, 40 per cent of Santa Clara's population was college educated) and many 'blue-collar' jobs were created as well. An incredible 500 000 new jobs evolved between 1940 and 1975 to cater in some capacity for the 8 000 high-tech firms stationed in Silicon Valley (Larson and Rogers,1988,107).

The wealth generated in Silicon Valley's peak years, generally considered to be the 1970's early 1980's, was staggering. The region became the country's ninth-largest manufacturing centre with sales of over $40 billion annually. As well, the Valley had the impressive ability to create 40 000

Figure 3.5



Source: "Silicon Valley and Route 128: Regional Prototypes or Historical Exceptions?". A. Saxenian. In High-Technology and Society. Edited by M. Castells. (1985) pp.84.

new jobs for each year in the early 1980's. It is estimated the region fostered over 15 000 millionaires and created a society driven by an attitude of never-ending prosperity (Larsen and Rogers,1988,100) up until, at least, recently.

By 1985, it became evident that the region's economy had slowed. The massive growth of Silicon Valley's population brought with it various pressures associated with an increasing urban agglomeration. Traffic congestion and inflating house and land prices caused young scientists and engineers to look elsewhere for employment and would-be new high-tech firms to reconsider the Silicon Valley option. Perhaps even more significant in terms of the Valley's economic 'evening-off' had to do with the emergence of an international competition from Asia and particularly Japan. Foreign trade with Japan's growing microelectronic industry had hurt Silicon Valley's domestic economy; ramifications of which are still being felt today. However, this does not signal the 'end' of Silicon Valley, but merely a phase of adjustment into maturity.

> Silicon Valley is going through a period of major restructuring. The valley is decreasing its reliance on its two basic industries - semiconductors and computers- and expanding its focus to encompass the applications of microelectronics components. This move to applications brings a much wider array of industries and activities into Silicon Valley (Larson and Rogers,1988,113).

Apparently, the lay-offs and economic slow-down of the late 1980's are being delt with, firstly, through the area's transition into sub-industries of microelectronics, such as medical electronics, telecommunications, and biotechnology; and, secondly, via a pronounced emphasis on even greater research activities rather than competing directly with foreign manufacturing (Saxenian,1985,93). All indications are that Silicon Valley will remain the hub of high-tech activity in America even regardless of perhaps a severe adjustment period.

A similar situation exists along a Boston regional highway, which is now better known as Route 128 - the East Coast's answer to Silicon Valley. The region rose to international importance on

the strength of a dense agglomeration of successful technology-based companies (Botkin,1988,117). By the mid-1970's, over 600 high-tech firms were 'housed' in 16 industrial parks along Route 128. Unfortunately, like the Silicon Valley experience, this massive prosperity led to an eventual slow-down caused, similarly, by internal congestion problems and external competition (Saxenian,1985,93). Never-the-less, technology continues to dominate this region's economy in a way seldom witnessed elsewhere.

The overall impact of these information centres on the prosperity of their respective regions has been well studied; if, for no other reason, to ponder the likelihood of emulating these successes in other destinations. Silicon Valley, Route 128 and North Carolina's Research Triangle are true high-tech growth-centres; real-life illustrations of what Schumpeter hypothesized would happen if internal innovation was properly nutured. The local universities, in each situation, were integral in creating an environment conducive to research which induced the clustering of high-tech activity to, subsequently, diversify the region's economy. Therefore, if research centres are to be used in other setting, as a regional development ploy, then the strategic placement of a university seems inevitable.

Consequently, the encompassing effect of a university on its hinterland, in both direct and indirect terms, is quite impressive. Whether through, say, direct local expenditure, social programs or by attracting high-tech industry; the influence of the university is so greatly diverse that it is unlikely that any other single institution could aid a region in so many different capacities. It was shown throughout this chapter how one could, either through estimates or intuition, visualize the scope of a single university's regional benefit but, unfortunately, accuracy was often in doubt. As well, with the exception of direct economic impact studies which are forced to use highly conservative estimates, the university's effect is generally unquantifiable.

In efforts to more closely show the advantages regions with universities seem to have over

regions without them, the following chapter will strive to estimate more clearly this relationship through an aggregate analysis. The emphasis will be away from micro 'effects' towards aggregate 'results'. Or, in other words, determining what the results on well-being are for Canadian regions with universities versus those without is the task to be undertaken.

CHAPTER 4 - THE EFFECT OF UNIVERSITIES ON THEIR LOCAL GEOGRAPHIC SPACE (A CANADIAN AGGREGATE VIEW)

Every university in Canada casts an identifiable shadow of influence over its immediate region. And, of course, one way to gain a Canada-wide view would be to undertake the monsterous task of separately considering each situation and drawing conclusions from each university impact case. A far more effective route to pursue is to analyze the simultaneous effect of all Canadian universities in aggregate terms. Thus, by utilizing this rather unique approach, this chapter will address the following key questions:

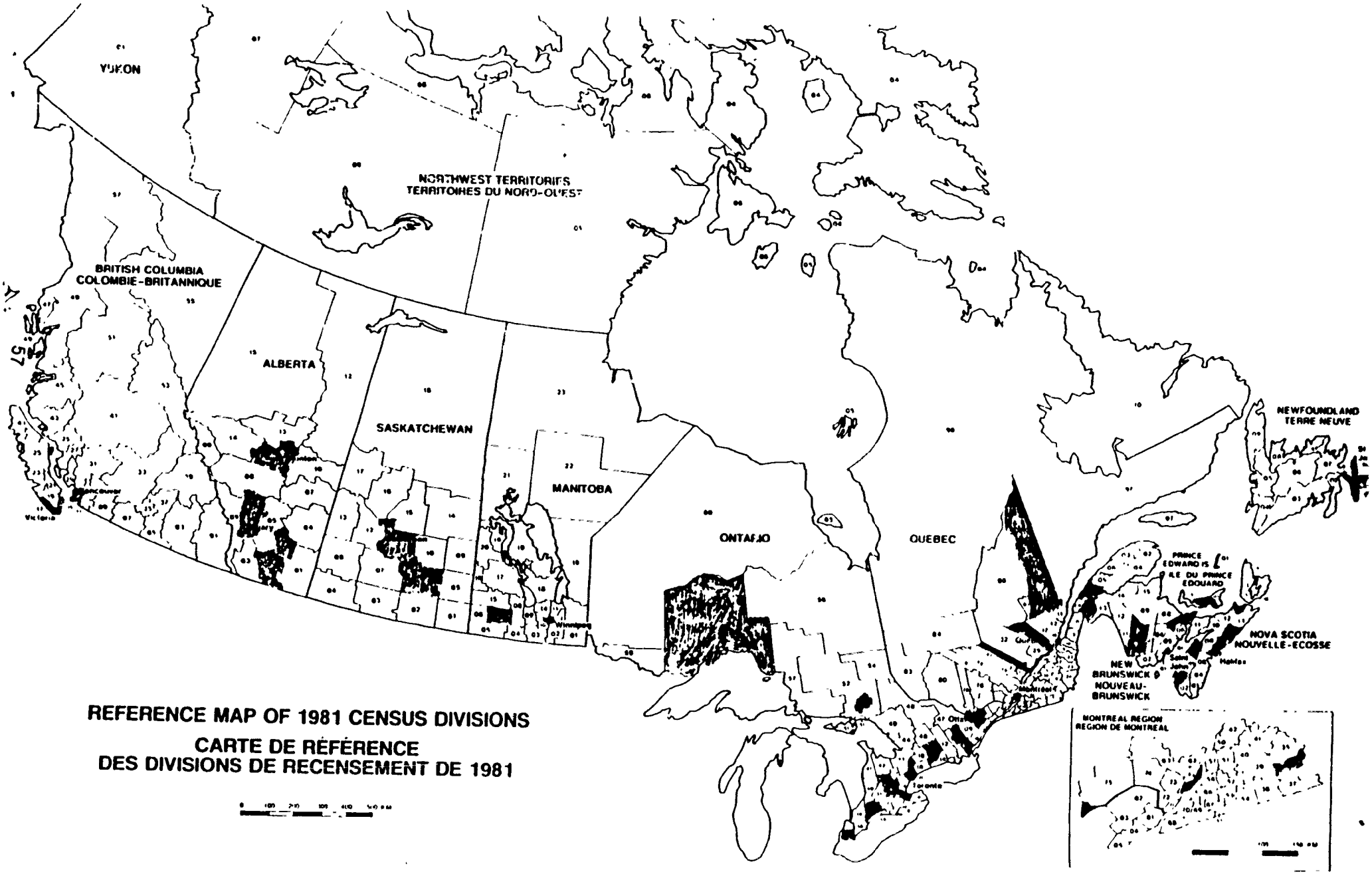
1) Are universities acting as growth-poles in Canada and thereby creating a higher level of economic well-being in the regions in which they are located? 2) To what extent do quaternary industry-university relationships exist? 3) How spatially localized is the 'university-pole's' effect? 4) Can some specific, economic and social factors be identified in explaining any advantage university communities may benefit from?

4.1) Defining the Analysis

In very plain terms, the actual mechanics of this analysis are concerned with revealing any effect that universities may have on economic well-being over Canadian space. In order to do this, Canada will be divided into three distinct geographic areas using the 266 census divisions. The first group will consist of the 37 census divisions in Canada that, as of 1981, have at least one university within their borders. Figure 4.1 shows this visually and at a glance the university census divisions are generally well dispersed with a reasonsable bias towards the urban centres, but not exclusively so. At this stage no distinction is made between universities in terms of their

Figure 4.1

University Census Divisions in Canada



age, specialization or length of existence. There are another 97 census divisions which are just adjacent (either North, South, East or West) to the university census divisions and will comprise the second group of observations. And, the third group is made up of the remaining 132 census divisions which fall into neither of the two above categories. Therefore, the three groups to be cross-examined are census divisions with: universities, adjacent to universities and spatially furthest from universities.

To justify initially that there is reason to speculate that regional conditions vary on the strength of where a university is located in space, a wide-array of socio-economic variables were considered to see if variance existed between the three groups of observations. This preliminary exercise is included in order to understand if this Canada-wide survey is consistent with the literature in ascertaining that, firstly, universities do make a difference in socio-economic condition and, secondly, that this difference surfaces in several ways. The statistical procedure oneway ANOVA "separates the total sample variance into two distinct components, one of which is identified with the chosen explanatory variable, the other with random effects" (Norcliffe, 1982,159), and is therefore of use in this application. Essentially, the variables listed on Figure 4.2 will be tested to see if the variance difference between the group means is significantly greater than the variance within the groups for the three categories of census divisions. The variables themselves measure various income, employment, occupational, schooling and housing characteristics and are so selected as to be possibly related to the presence, or absence, of a university. Thus, depending on how many of these socio-economic indicators are deemed as significant by oneway ANOVA, the potential effect of universities can be generally determined and the justification for extending this exercise can be provided.

However, the growth-pole argument, made in the literature and pursued herein, directly implies that universities are not just a reason for various spatial differences, but that their effect is clearly

Figure 4.2

THE INITIAL VARIABLE POOL - BY CATEGORY

INCOME	
AVERAGE INCOME	(AVEINC)
HIGH INCOME INDIVIDUALS	(HIGHI)
LOW INCOME INDIVIDUALS	(LOWINI)
LOW INCOME FAMILIES	(LOWINF)
OCCUPATION	
OCCUPATION IN MANAGERIAL OR ADMIN.	(OMA)
OCCUPATION IN NAT. SC., ENGIN., MATH.	(ONSEM)
OCCUPATION IN SOCIAL SCIENCES	(OSS)
OCCUPATION IN TEACHING	(OTEAC)
OCCUPATION IN MEDICINE & HEALTH	(OMH)
OCCUPATION IN ARTS & LITERATURE	(OART)
SELF EMPLOYED	(SELF)
OCCUPATION IN RELIGION	(ORELI)
OCCUPATION IN CLERICAL WORK	(OCLER)
OCCUPATION IN SALES	(OSALES)
OCCUPATION IN SERVICES	(OSERV)
OCCUPATION IN PROCESSING	(OPROC)
OCCUPATION IN COMMUNICATION OR BUSINESS	(COMBU)
OCCUPATION IN MINING	(MINE)
OCCUPATION IN PUBLIC ADMIN. & DEFENSE	(PUBDE)
OCCUPATION IN MANUFACTURING	(MAN)
OCCUPATION IN FINANCIAL OPERATIONS	(FINA)

Figure 4.2 (Cont'd)

OCCUPATION IN FISHING	(FIS)
OCCUPATION IN AGRICULTURE	(AGRI)
OCCUPATION IN FORESTRY	(FORES)
OCCUPATION IN CONSTRUCTION	(CONS)
OCCUPATION IN TRANSPORTATION & COMMUNICATIONS	(TRACO)
OCCUPATION IN TRADE	(TRAD)
QUATERNARY EMPLOYMENT	(QUAT)
ALL INDUSTRIES	(ALLIN)
HOUSING	
HOUSE VALUE	(HOUSV)
AVERAGE RENT	(ARENT)
PERSONS PER ROOM	(PPM)
SCHOOLING	
ATTENDED UNIVERSITY - NO DEGREE	(UWOD)
ATTENDED UNIVERSITY - WITH DEGREE	(UWD)
FULL TIME STUDENT	(SFT)
LOW EDUCATION (LESS THAN GRADE 10)	(LOED)
MOBILITY	
MIGRATED FROM OUTSIDE CANADA	(MIGOCA)
NON-MIGRANT	(NONMIGR)
NON-MOVER	(NONMO)
NET IN-MIGRATION	(NETIM)
EMPLOYMENT	
FEMALES UNEMPLOYED 15 TO 24	(FU1524)

Figure 4.2 (Cont'd)

FEMALE PARTICIPATION RATE 15 TO 24	(FP1524)
FEMALE PARTICIPATION RATE	(FPR)
FEMALES NOT IN LABOUR FORCE	(FNOLF)
FEMALE UNEMPLOYMENT RATE	(FUN)
MALES UNEMPLOYED 15 TO 24	(MU1524)
MALE PARTICIPATION RATE 15 TO 24	(MP1524)
MALE PARTICIPATION RATE	(MPR)
MALES NOT IN THE LABOUR FORCE	(MNOLF)
MALE UNEMPLOYMENT RATE	(MUN)
LABOUR RATE	(LABR)

OTHER

POPULATION GROWTH (1976-1981)	(POPGR)
POPULATION DENSITY (KM)	(POPDEK)
NUMBER AGED 20 TO 24	(T2024)
NUMBER SINGLE	(SINGL)
HUSBAND AND WIFE FAMILIES	(HWFAML)
NUMBER SPEAKING FRENCH	(FRENC)
BORN IN CANADA	(BORCAN)
BORN IN UNITED STATES	(BORUS)

All Variables were taken from the 1981 Census Summary Paper.

positive. And, the best way to pursue this from a university growth-pole perspective is to see specifically how well-being varies across the three sets of observations.

Thus, given the apparent need to focus this analysis, how then is well-being to be understood within the realm of this aggregate study? As was eluded to in the last chapter, and particularly in Found's impact study of York University, a university tends to, in economic terms, increase local: expenditure, employment, population and high-tech acti··ity. Interestingly enough, all of these criteria can double as indicators of regional well-being as well. A larger local expenditure would be reflected in higher average incomes, which is perhaps the most common measure of economic well-being. Similarly, the labour rate and population growth are equally usable illustrators of regional conditions. Now, the prevailing level of high-tech involvement may or may not be an adequate surrogate for well-being but, here it has a dual purpose, This study is also seeking to understand the relationship between high-tech and higher education resources. Thus, the inclusion of a high-tech measure, echoed by quaternary employment, within this study, to some, might not satisfy as a well-being measurement but it is still of interest to see if university locales boast higher levels of quaternary involvement.

Using 1981 census data, the analysis' four measures of well-being were created. The average income, the labour rate and population growth variables are calculated as rates of the total census division's population, in efforts to eliminate the 'bigness' bias of some census divisions, and should be self-explanatory. The quaternary rate variable, the surrogate for high-technology involvement, is comprised of people in higher education-type occupations (quaternary professions) and is also expressed as a rate of the population. Incidentally, entrepreneurs are generally self-employed and many are involved in high-tech endeavours. However, people in agricultural occupations are also typically categorized as self-employed, but are not part of the quaternary picture and, therefore, need to be removed from consideration here (as the calculations

on Figure 4.3 show).

So, assuming it is the case that many of the 59 variables to be initially tested by oneway ANOVA display that socio-economic characteristics do vary with regards to where universities are in space, the basic goal of this exercise, then, becomes specifically concerned with detecting differences in well-being (measured by average income, population growth, the labour rate and quaternary employment) among census divisions with universities, those adjacent to university census divisions and the remaining census divisions in Canada.

Yet, a probably more interesting problem to consider involves not just understanding if a variation in well-being exists between the three groups but ascertaining where this difference lies. In other words, is the variation in well-being greater between the university and adjacent census divisions in comparison to the adjacent and remaining group or is the converse true? By association, if it is demonstrated, through mean scores and oneway ANOVA (the task previously outlined), that university locales do have higher levels of economic well-being, then there is some need to know how far this apparent university influence extends over space. By using the T-test to statistically evaluate the well-being mean scores for each of the three census division groups, some conclusions in this regard can be made. The logic being that, in terms of the four well-being indicators, if the university census divisions (growth-centres) have more in common with the adjacent ones than with the remaining census divisions in Canada, then the spread effects from the university communities are, at the very least, extending prosperity beyond the borders of the immediate census division. Understanding the spatial extent of this possible university growth-pole influence is the underlying motive for including this extension of the well-being analysis.

Thus, through the use of the T-test and oneway ANOVA it will hopefully be clarified if in fact universities are acting as growth-poles and generally how far this apparent effect extends over space. There is, however, one final step in this evaluation of university-influenced spatial well-

Figure 4.3

CALCULATIONS OF WELL-BEING INDICATORS

Labour Rate = Labour Force / Pop81

Population Growth = Pop81 - Pop76 / Pop76

Quaternary Rate = Managerial and Admin. + Nat. Sc. and Engin. and Math + Social Sc. + Teaching + Med. and Health + Arts and Lit. + Self Employed + Computer and Business (-Agriculture)

Average Income is a rate of the 1981 Population.

being that needs to be considered; that being, attempting to isolate some of the underlying reasons for a university locale's economic dominance (assuming that this is a valid conclusion to be drawn from the statistical procedures). Through regression analysis this concern will be addressed.

Regression analysis is a statistical tool used to evaluate the possible causality of one or more independent (predictor) variables on a dependent variable (Kleinbaum and Kupper,1978,34). Conceptually, it would be quite easy to construct regression models to isolate which socio-economic variables are good predictors of well-being (as described by the labour rate, quaternary rate, population growth and average income) but this would not accomplish the task at hand. To remain consistant with the on-going theme of this thesis, isolating those independent variables which help to explain well-being with respect to the university's influence is a far more relevent exercise. And, this can be accomplished with the use of a 'specialized pool' of variables within the regression procedure.

Creating this set of university-influenced variables is again accomplished via the T-test and is a critical component of this overall regression procedure. Of the original 59 socio-economic variables, only those which display a 'university distinct' characteristic, in which the variable in question has a mean value for the university census divisions that is significantly dissimilar from the rest of Canada, can be included. Which is to say that the independent variables must necessarily be already 'university-influenced' before entering the regression analysis. From here, it can then be determined which of these socio-economic indicators best explain well-being. Because, logically, to remain consistent with this inherent growth-pole theme, does it really matter if a variable in question reflects a university influence if well-being is not effected in some capacity? So, in a sense, this regression exercise is a means of 'ranking' the various socio-economic criteria that are effected by a university's presence (or absence) in regards to which of

them most adequately explain regional economic well-being.

Thus, with the use of this purposely biased group of potential independent variables, a series of regression equations will be created, one for each of the well-being indicators to act as the dependent variable, and the 266 census divisions in Canada will be the cases considered.

Before this discussion can continue, one more issue must be addressed. Undoubtedly, the harshest criticism that can be made against any results attained through the oneway ANOVA and the T-test applications involves the interjection of: how is it known if a higher level of prosperity existing within the 37 university census divisions is a result of the local university or merely accruing from the benefits of urban agglomeration? Plainly, high population densities and the ramifications of scale economies are indeed effecting regional well-being in conjunction with the local university and no study is going to accurately separate both effects. Yet, by including an independent variable within the regression procedure that is a measure of urban clustering it can, at least, be determined if such urban forces are significant in this university study. The measure itself is a binary dummy variable made up of census divisions that are part of a Census Metropolitan Area (assigned a value of 1) and those which are not (assigned a value of 0). Logically, if this CMA variable shows up strongly in any of the regression equations then, urban agglomeration must be conceded to be part of the total picture.

4.2) Differences in Well-Being

Table 4.1 displays the initial set of variables used throughout this chapter and indicates which variables were significant (at a 95 per cent confidence interval) in a oneway analysis of variance using the three census division groupings indicated above. Of the 59 variables, measuring a great range of socio-economic criteria, 46 (78 per cent) were significant; or, that the variation between the university, adjacent and remaining census divisions was not a result of chance but displays a

Table 4.1

VARIABLES DEEMED SIGNIFICANT BY ONEWAY ANOVA (YES)

VARIABLE	ABBREVIATION	SIGNIFICANCE
AVERAGE INCOME	(AVEINC)	YES
HIGH INCOME INDIVIDUALS	(HIGHI)	YES
LOW INCOME INDIVIDUALS	(LOWINI)	YES
LOW INCOME FAMILIES	(LOWINF)	
OCCUPATION IN MANAGERIAL OR ADMIN.	(OMA)	YES
OCCUPATION IN NAT. SC., ENGIN., MATH.	(ONSEM)	YES
OCCUPATION IN SOCIAL SCIENCES	(OSS)	YES
OCCUPATION IN TEACHING	(OTEAC)	YES
OCCUPATION IN MEDICINE & HEALTH	(OMH)	YES
OCCUPATION IN ARTS & LITERATURE	(OART)	YES
SELF EMPLOYED	(SELF)	YES
OCCUPATION IN RELIGION	(ORELI)	
OCCUPATION IN CLERICAL WORK	(OCLER)	YES
OCCUPATION IN SALES	(OSALES)	YES
OCCUPATION IN SERVICES	(OSERV)	YES
OCCUPATION IN PROCESSING	(OPROC)	
OCCUPATION IN COMMUNICATIONS/BUSINESS	(COMBU)	YES
EMPLOYED IN MINING	(MINE)	
EMPLOYED IN PUBLIC ADMIN. & DEFENSE	(PUBDE)	YES
EMPLOYED IN MANUFACTURING	(MAN)	
EMPLOYED IN FINANCIAL OPERATIONS	(FINA)	YES
EMPLOYED IN FISHING	(FIS)	

Table 4.1 (Cont'd)

EMPLOYED IN AGRICULTURE	(AGRI)	YES
EMPLOYED IN FORESTRY	(FORES)	YES
EMPLOYED IN CONSTRUCTION	(CONS)	
EMPLOYED IN TRANSPORTATION & COMMUNICATIONS	(TRACO)	
EMPLOYED IN TRADE	(TRAD)	YES
QUATERNARY EMPLOYMENT	(QUAT)	YES
ALL INDUSTRIES	(ALLIN)	YES
NUMBER AGED 20 TO 24	(T2024)	YES
HUSBAND AND WIFE FAMILIES	(HWFAML)	YES
NUMBER SPEAKING FRENCH	(FRENC)	YES
NUMBER SINGLE	(SINGL)	YES
PERSONS PER ROOM	(PRM)	YES
HOUSE VALUE	(HOUSV)	YES
AVERAGE RENT	(ARENT)	YES
POPULATION DENSITY IN KM.	(POPDEK)	YES
POPULATION GROWTH (1976-1981)	(POPGR)	
ATTENDED UNIVERSITY - NO DEGREE	(UWOD)	YES
ATTENDED UNIVERSITY - WITH DEGREE	(UWD)	YES
FULL TIME STUDENT	(S[illegible]T)	YES
LOW EDUCATION (LESS THAN GRADE 10)	(LOED)	YES
MIGRATED FROM OUTSIDE CANADA	(MIGOCA)	YES
NON-MIGRANT	(NONMIGR)	YES
NON-MOVER	(NONMO)	YES
NET IN-MIGRATION	(NETIM)	
BORN IN CANADA	(BORCAN)	YES
BORN IN UNITED STATES	(BORUS)	

Table 4.1 (Cont'd)

FEMALES UNEMPLOYED 15 TO 24	(FU1524)	YES
FEMALE PARTICIPATION RATE 15 TO 24	(FP1524)	YES
FEMALE PARTICIPATION RATE	(FPR)	YES
FEMALES NOT IN LABOUR FORCE	(FNOLF)	YES
FEMALE UNEMPLOYMENT RATE	(FUN)	YES
MALES UNEMPLOYED 15 TO 24	(MU1524)	
MALE PARTICIPATION RATE 15 TO 24	(MP1524)	YES
MALE PARTICIPATION RATE	(MPR)	YES
MALES NOT IN THE LABOUR FORCE	(MNOLF)	YES
MALE UNEMPLOYMENT RATE	(MUN)	
LABOUR RATE	(LABR)	YES

Source: Statistic Canada 1981 Summary Tapes.

true pattern of spatial variation. Thus, the ANOVA test gives a clear indication that universities are effecting Canada's socio-economic condition, but is the proposed university growth-pole phenomenon emerging? To answer this inquiry, results from the well-being analysis must be addressed.

If, in fact, universities are acting as growth-poles in Canada, then the census divisions with universities should exhibit a higher level of well-being relative to the rest of Canada. And, by the results listed on Table 4.2, and summarized on Table 4.3, it appears that such a situation has occurred.

Looking, then, at the mean scores of the variables for each of the three groups on Table 4.3, some interesting observations can be made; especially with regards to the higher levels shown for the university census divisions in comparison to the other two groups. Well-being, at least for average income, the labour rate and the quaternary rate; is higher in university locales. And, conveniently, it is these same three variables that were established as significant by oneway ANOVA as Table 4.2 illustrates. It should be known, that for a variable to be significant at a 95 per cent confidence interval, it must have an F-probability ratio of less than 0.05; a condition which is not met for the variable population growth. Hence, not only do university census divisions show a higher level of well-being, for three out of four of the indicating variables, but the variance between the three groups of observations is distinctly justified by oneway ANOVA.

As a result, it is now safe to exclaim that universities in Canada are generally acting as growth-poles and encouraging a higher level of economic prosperity within the regions in which they dwell. As well, due to the fact that there is a significantly superior level of quaternary employment in university census divisions relative to the rest of Canada, there does seem to be some validity to the often made argument regarding university and high-technology industry attraction. Yet, as encouraging as these results appear, the investigation needs to be furthered.

Table 4.2

ONEWAY ANALYSIS OF VARIANCE AND SIGNIFICANCE

Variable AVEINC
By Variable UNI

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	191805319.5	95902659.73	7.9784	.0004
Within Groups	263	3161320529	12020230.15		
TOTAL	265	3353125849			

Variable QUAT
By Variable UNI

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	2355.6478	1177.8239	55.9275	.0000
Within Groups	263	5538.7379	21.0598		
TOTAL	265	7894.3857			

Variable POPGR
By Variable UNI

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	.0104	.0052	.7296	.4831
Within Groups	263	1.8821	.0072		
TOTAL	265	1.8926			

Variable LABR
By Variable UNI

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	2	.0760	.0380	18.2392	.0000
Within Groups	263	.5480	.0021		
TOTAL	265	.6240			

Table 4.3

MEANS, STANDARD DEVIATIONS AND ONEWAY ANOVA RESULTS FOR THE WELL-BEING INDICATORS

	UNIVERSITY (37)		ADJACENT (97)		OTHER (132)		ONEWAY
VARIABLE	Mean	SD	Mean	SD	Mean	SD	SIGNIFICANCE
Average Income	24361.27	3458.80	21700.31	3187.54	22254.89	3660.44	YES
Labour Rate	.4914	.047	.4481	.042	.4404	.048	YES
Population Growth	.0522	.070	.0496	.073	.0627	.096	NO
Quaternary Rate	.2873	.051	.1963	.049	.2068	.042	YES

4.3) The Extent of the University Effect

The results obtained thus far seem to indicate the presence of growth-centres, in some degree, through the influence of universities in many Canadian destinations. Yet, in order to expand the comprehensiveness of this study, it would be of value to understand how far this apparent university-induced prosperity is extending to over space. The reader should be forewarned that this procedure is limited to the scale of the census division and, therefore, any observations made regarding a university's spatial influence will only be a gross estimate.

Table 4.4 shows the results of the T-test's mean evaluation and using either the pooled or separate variance estimate, the implications regarding significance remains largely the same. Table 4.5 provides a summary of the computer output and deserves closer attention.

When the mean scores of the well-being indicating variables were tested for the 37 university and 97 adjacent census divisions, the T-test established significance; meaning that for a 95 per cent confidence interval the mean scores between these two groups are statistically distinct. It should be noted that the variable population growth was included within the T-test for interest sake but is really of no consequence here because, as was witnessed earlier, it was the one variable that exhibited no variation between the three groups. Thus, for the variables of importance (average income, the labour rate and the quaternary rate), the higher average values in university regions are statistically distinct from the lower mean values in the census divisions just adjacent.

However, when an identical procedure was pursued for comparing the adjacent to the remaining Canadian census divisions, the results were opposite to the previous execution. As Table 4.6 illustrates and Table 4.5 summarizes, the T-test revealed that the mean scores between the 97 adjacent and the 132 remaining census divisions were not statistically unique. And, accordingly, when the university census divisions were compared to the remaining group, as a 'check' on the analysis, statistical distinctiveness prevailed once again.

Table 4.4

T-TEST COMPARING UNIVERSITY AND ADJACENT

GROUP 1 - UNI EQ 1.00 (UNIVERSITY CD'S)
GROUP 2 - UNI EQ 2.00 (ADJACENT CD'S)

			POOLED VARIANCE ESTIMATE						*	SEPARATE VARIANCE ESTIMATE		
Variable		Number of Cases	Mean	Standard Deviation	Standard Error	T Value	Degrees Of Freedom	2-Tail Prob.	*	T Value	Degrees Of Freedom	2-Tail Prob.
GUAT									*			
	Group 1	37	30.3885	4.622	.760	6.05	132	.000	*	6.05	65.09	.000
	Group 2	97	24.9855	4.617	.469				*			
AVEINC									*			
	Group 1	37	24361.2703	3458.794	568.622	4.22	132	.000	*	4.07	60.71	.000
	Group 2	97	21700.3093	3187.538	323.645				*			
POPGR									*			
	Group 1	37	13805.3784	39159.230	6437.738	2.25	132	.026	*	1.53	38.80	.135
	Group 2	97	3786.3711	12430.788	1262.155				*			
LABR									*			
	Group 1	37	.4914	.047	.008	5.17	132	.000	*	4.92	59.30	.000
	Group 2	97	.4481	.042	.004				*			

Table 4.5

T-TEST RESULTS MEASURING WHERE SIGNIFICANT VARIANCE IS FOR WELL-BEING INDICATORS

	Uni To Adj	Adj To Rest	Uni To Rest
Average Income	YES	NO	YES
Labour Rate	YES	NO	YES
Quaternary Rate	YES	NO	YES
Population Growth*	NO	NO	NO

*Deleted from the analysis after oneway ANOVA (Table 4.2), but is equally non-significant in all cases here.

Table 4.6

T-TEST COMPARING ADJACENT TO REST

GROUP 1 - UNI EQ 00 (REST CD'S)
GROUP 2 - UNI EQ 2.00 (ADJACENT CD'S)

Variable		Number of Cases	Mean	Standard Deviation	Standard Error	POOLED VARIANCE ESTIMATE T Value	Degrees Of Freedom	2-Tail Prob.	SEPARATE VARIANCE ESTIMATE T Value	Degrees Of Freedom	2-Tail Prob.
GUAT	Group 1	132	24.2374	3.831	.333	-1.34	227	.182	-1.30	183.32	.195
	Group 2	97	24.9855	4.617	.469						
AVEINC	Group 1	132	22254.8864	3660.440	318.600	1.20	227	.233	1.22	220.48	.223
	Group 2	97	21700.3093	3187.538	323.645						
POPGR	Group 1	132	3579.5455	6789.627	590.961	- .16	227	.872	- .15	137.85	.882
	Group 2	97	3786.3711	12430.788	1262.155						
LABR	Group 1	132	.4403	.048	.004	-1.28	227	.201	-1.31	220.25	.192
	Group 2	97	.4481	.042	.004						

This simple exercise has some far-reaching implications. Namely, not only do university census divisions have a higher level of well-being, but it is a very localized trait not shared by neighbouring census divisions which, in turn, seem to have more in common with more distant destinations. One could then speculate that, using Hirschman's terminology, backwash effects are outweighing spread effects in areas where the university's dominance is reflected in a very localized community prosperity. Therefore, the higher level of well-being common to university census divisions, as was significantly determined by oneway ANOVA, may indeed reveal the existence of a university growth-pole phenomenon for the general Canadian picture, but due to (perhaps) the forces of polarization, peripheral areas are not benefiting to any measurable degree as prosperity remains highly spatially immediate (as shown by the T-tests).

One further conclusion can be drawn from this analysis. The quaternary rate, as has been defined, has a dual purpose: it serves as an indicator of well-being and also as a measure of high-technology involvement. If, in fact, universities are attracting a superior level of high-tech activity into the area, as appears to be the case, then the outcome is as well a very localized occurence. The quaternary rate remains uniquely high in the 37 university census divisions but not, in relative terms, any where else in Canada. The literature predicts the eventual spin-off of new high-tech production-type firms from areas of innovative concentration (often university census divisions) to more peripheral settings. The results of the T-test, although not completely conclusive in this regard, certainly do not show any such trend.

4.4) Localized University Dominance - The Search For Reasons

It has been established that economic well-being is generally higher in the 37 Canadian university census divisions; in aggregate terms, the growth-pole effect seems to be occurring. This, in itself, is an interesting conclusion to attain. However, can the analysis be expanded

towards realizing some of the reasons that may be contributing to this localized university-pole phenomenum? Or, to slightly rephrase this question, can it be understood what economic or social characteristics university communities, in aggregate, possess that allow for this relatively higher level of well-being. It is in response to this inquiry that regression analysis can be of some use.

To reinterate, it is hoped that regression analysis can uncover factors that are contributing to the university's spatially immediate effect on economic well-being. It is crucial to understand, as has been stressed, that the only variables that can be tested as potential predictors of well-being must necessarily possess this same trait. In other words, the initial variable pool used throughout this chapter (Table 4.1) must be reduced to include only variables that are significantly distinct for university census divisions. Figure 4.4 lists the variables which, by applying the T-test in a fashion identical to what was outlined before, have mean values that are unique for the 37 university census divisions. However, just because these variables exhibit a uniqueness for university census divisions, does not mean they all necessarily explain well-being or add to a better realization of why university communities are prosperous. For this reason, these 29 socio-economic variables, roughly half of the original variable pool, must subsequently be tested through regression to see which emerge as adequate predictors of economic well-being.

4.4.1) The Regression Analysis

Therefore, with the inclusion of the CMA dummy variable, there is a total of 30 socio-economic indicators to be considered in each of the three regression equations. However, slight moderations in each of the three models needs to be made because of a collinear bias in some of the independent variables. For example, when running regression with the labour rate as the dependent variable, any of the employment and labour participation rate variables were not

Figure 4.4

VARIABLES INCLUDED IN THE REGRESSION ANALYSIS

(All are distinctly unique for University Census Division, compared to the rest of Canada, as determined by the T-Test.)

OMA	FP1524
ONSEM	FPR
OSS	FNOLF
OMH	MPR
OART	MNOLF
OCLER	ARENT
OSALES	HOUSV
OSERV	UWOD
COMBU	UWD
PUBDE	SFT
FINA	MIGOCA
ALLIN	BORNCAN
FORES	LOWINI
TRAD	HIGHI
POPDEK	

included because of a high level of relatedness. Thus, outside of eliminating variables that were measuring similar criteria (and merely echoing) the dependent variable, all three regression equations used the same pool of variables.

There is, however, some question as to how many independent variables to include in each model. Ultimately, the focal point of regression analysis comes down to the trade-off between predictive power and simplicity (Thorndike,1978,34). The model's power at explaining the dependent variable on the strength of the independent variables is given by the R-squared value (the coefficient of determination). The level of simplicity is related to the number of significant, important and causal independent variables used in the equation; where significance is measured by the T-tests, importance by the weighted beta values and causality is justified intuitively by the researcher. Obviously, the fewer causal components present in the analysis, the easier it will be to isolate the effects of particular independent variables and, therefore, understand which variables most adequately explain the dependent variable. Therefore, the researcher must strive to maximize the model's explaining power but not at the expense of simplicity and construct a model that is too complex to interpret.

Since, when using the SPSSX software package, variable entry is accomplished via a stepwise procedure, in which the most important independent variables are entered into the equation step by step, and only variables which pass the internal T-test are considered; some of the subjectivity of variable inclusion is eliminated. Yet, there are still some choices that need to be made before the regression models considered here are complete and of use to this specific analysis.

Tables 4.7, 4.8 and 4.9 show the stepwise process of variable entry that occurred when the quaternary rate, average income and labour rate (respectively) were used as the dependent variable. When all three models are considered together, a total of 26 predictor variables are ultimately retained with, in all three cases, R-squared values at more than satisfactory levels. Yet,

Table 4.7

STEPWISE REGRESSION WITH DEPENDENT VARIABLE: QUATERNARY RATE

SUMMARY TABLE

Step	MultR	Rsq	AdjRsq	F(Eqn)	SigF	RsqCh	FCh	SigCh		Variable	BetaIn	Correl
1	.8369	.7004	.6996	617.276	.000	.7004	617.276	.000	In:	UWOD	.8369	.8369
2	.8592	.7382	.7362	370.794	.000	.0378	37.940	.000	In:	OCLER	.3265	.7882
3	.8758	.7670	.7643	287.451	.000	.0286	32.354	.000	In:	OSERV	.1881	.5237
4	.8888	.7900	.7868	245.482	.000	.0230	28.631	.000	In:	MPR	-.1852	.3285
5	.9051	.8193	.8158	235.705	.000	.0282	42.073	.000	In:	PUBDE	-.2394	.3499
6	.9133	.8342	.8303	217.173	.000	.0149	23.324	.000	In:	MIGOCA	-.1732	.4517
7	.9254	.8563	.8524	219.609	.000	.0221	39.671	.000	In:	FNOLF	-.2242	-.3855
8	.9322	.8690	.8649	213.121	.000	.0127	24.957	.000	In:	HIGHI	.2012	.5632
9	.9366	.8772	.8729	203.141	.000	.0082	17.020	.000	In:	BORCAN	.1790	-.4292
10	.9386	.8810	.8763	183.759	.000	.0038	8.164	.005	In:	OSALES	.1285	.6462
11	.9416	.8865	.8816	180.433	.000	.0056	12.445	.000	In:	UWD	-.1297	.5476
12	.9437	.8905	.8853	171.463	.000	.0040	9.148	.003	In:	FORES	.0732	-.0320
13	.9451	.8931	.8876	162.004	.000	.0028	8.200	.013	In:	FPR	.1961	.6407
14	.9447	.8925	.8874	175.020	.000	-.0008	1.518	.219	Out:	FNOLF		-.3855
15	.9467	.8963	.8910	167.501	.000	.0038	9.340	.002	In:	ALLIN	-.2140	.5477
16	.9479	.8984	.8926	158.601	.000	.0021	5.209	.023	In:	FNOLF	.2401	-.3855

Table 4.8

STEPWISE REGRESSION WITH DEPENDENT VARIABLE: AVERAGE INCOME

SUMMARY TABLE

Step	MultR	Rsq	AdjRsq	F(Eqn)	SigF	RsqCh	FCh	SigCh		Variable	BetaIn	Correl
1	.8047	.6475	.6461	484.695	.000	.6475	484.895	.000	In:	MPR	.8047	.8047
2	.8649	.7470	.7461	390.878	.000	.1005	104.944	.000	In:	HOUSV	.3661	.6768
3	.8916	.7949	.7925	338.460	.000	.0469	59.867	.000	In:	ONSEM	.2619	.6649
4	.8978	.8050	.8030	271.024	.000	.0111	14.890	.000	In:	ALLIN	-.2393	.7426
5	.9039	.8169	.8134	232.068	.000	.0110	15.600	.000	In:	OCLER	.1951	.6998
6	.9083	.8268	.8286	206.069	.000	.0099	14.743	.000	In:	TRAD	-.1675	.4986
7	.9119	.8316	.8270	192.017	.000	.0048	7.357	.007	In:	CM	-.0865	.3530
8	.9138	.8551	.8390	162.700	.000	.0035	5.459	.020	In:	OMA	.0994	.6977
9	.9162	.8394	.8338	148.703	.000	.0043	6.892	.009	In:	FORES	.0780	.0050
10	.9181	.8426	.8657	176.744	.000	.0034	5.514	.020	In:	MIGOCA	-.0918	.5775
11	.9220	.8506	.8436	130.876	.000	.0072	12.190	.001	In:	BORCAN	-.1875	-.6300

Table 4.9

STEPWISE REGRESSION WITH DEPENDENT VARIABLE: LABOUR RATE

SUMMARY TABLE

Step	MultR	Rsq	AdjRsq	F(Eqn)	SigF	RsqCh	FCh	SigCh		Variable	BetaIn	Correl
1	.7477	.5591	.5574	334.755	.000	.5591	334.755	.000	In:	OCLER	.7477	.7477
2	.8169	.6674	.6648	263.811	.000	.1083	85.597	.000	In:	BORCAN	-.3880	-.6753
3	.8324	.6928	.6893	196.999	.000	.0255	21.749	.000	In:	HIGHI	.2447	.7185
4	.8553	.7316	.7275	177.838	.000	.0387	37.661	.000	In:	TRAD	.3006	.6960
5	.8660	.7500	.7452	156.007	.000	.0184	19.167	.000	In:	LOWINI	.1525	.2523
6	.8714	.7594	.7538	136.251	.000	.0094	10.117	.002	In:	HOUSV	-.1784	.6103
7	.8768	.7687	.7624	122.492	.000	.0093	10.368	.001	In:	OSERV	.1086	.4264
8	.8807	.7756	.7686	111.011	.000	.0069	7.858	.005	In:	PUBDE	-.1401	.1620
9	.8872	.7872	.7797	105.224	.000	.0116	14.000	.000	In:	OMA	.1993	.6913
10	.8902	.7925	.7844	97.409	.000	.0053	6.547	.011	In:	POPDEK	-.0900	.2721
11	.8924	.7965	.7876	90.355	.000	.0039	4.905	.028	In:	OSS	-.0825	.3754
12	.8943	.7997	.7902	84.193	.000	.0033	4.136	.043	In:	FINA	-.1455	.6804
13	.8962	.8032	.7930	79.105	.000	.0034	4.416	.037	In:	UWD	-.0962	.6085
14	.8983	.8069	.7961	74.912	.000	.0037	4.817	.029	In:	ARENT	.1117	.6980
15	.9006	.8111	.7998	71.573	.000	.0042	5.603	.019	In:	OMH	.0921	.4655
16	.9024	.8143	.8024	68.248	.000	.0032	4.282	.040	In:	COMBU	-.1510	.6258
17	.9020	.8136	.8024	72.751	.000	-.0007	.945	.332	Out:	TRAD		.6960
18	.9011	.8120	.8015	77.453	.000	-.0016	2.114	.147	Out:	OSS		.3754

at this point, one further 'screening process' in independent variable consideration is required.

It is of little use having three regression equations measuring distinct criteria when this analysis is concerned with evaluating well-being, as influenced by universities, in a fashion that is revealed through the three regression models collectively. As a result, some method of combining the equations is needed. Ideally, the best way to accomplish this would be to consider only variables that appeared in all three of the equations. Unfortunately, only OCLER and BORCAN fit this rigid specification and a well-being regression equation comprised of two independent variables, although quite powerful, reveals little. So, it is necessary to slacken the restrictions on variable consideration in order to gain more information on what criteria are effecting university-influenced well-being. Fittingly, a logical decision to make here is to consider any variable, as a predictor of well-being, which surfaced in at least two of the regression models. Using this method allows for more variables to be evaluated and at the same time to still retain the necessary well-being, as opposed to a specific dependent variable, interpretation.

Figure 4.5 shows the thirteen variables that have been segregated, by the stepwise process, as the most adequate predictors of well-being. Also displayed is the direction of effect, given by the partial correlation values, that each indicator has with the dependent variable. These variables, along with the CMA dummy variable, were then put into the final regression run in efforts to see what the collective causal effects on well-being are, as Table 4.10 summarizes. Notice that not all of the independent variables have remained significant, at a 95 per cent confidence interval, and that others now exhibit a new direction of effect on well-being when the 'b' values of the regression models are considered. At any rate, the summit of this exercise is, in fact, represented by these regression models but some issues must be addressed before relevent interpretations can be carried out.

The R-squared values, given on Table 4.10, reveal that the 14 independent variables can

Figure 4.5

VARIABLES DEEMED SIGNIFICANT BY THE STEPWISE PROCESS WITH DIRECTION OF EFFECT INDICATED BY PARTIAL CORRELATION

+OCLER

−BORCAN

+HIGHI

+TRAD

+HOUSV*

+OSERV

+PUBDE

+OMA

+UWD

+MPR*

+MIGOCA

+ALLIN

−/+FORES (Negative with QUAT, Positive with AVEINC)

*All expressed as rates of the 1981 population except as indicated.

Table 4.10

THE WELL-BEING REGRESSION EQUATIONS

$a + b_1 x_1 + b_2 x_2 \ldots$ $\ldots b_{14} x_{14}$

	CONSTANT	BORCAN	FORES	PUBDE	CMA	MPR	TRAD	UWD	OSERV	HOUSV	MIGOCA	OMA	HIGHI	OCLER	ALLIN	N	R^2
ZINC 1	.14	-.87 *	.40 *	-2.15 *	-.06 *	.05 *	-6.93 *	.93	3.4 *	-04 4.0E *	-6.22 *	7.14 *	/ 2	8.22 *	-2.19 *	266	84.45%
R	.42	-.13 *	-.14	- .49 *	-.003	/ 2	.62 *	-.11	.95 *	-07 -3.8E *	.32	.80 *	.40 *	.53 *	/ 2	266	77.16%
T	.13	.15 *	.32 *	- .76 *	.003	-.005 *	- .36	.26	1.59 *	-08 1.5E	- .29	1.02 *	.38 *	1.82 *	.17	266	76.72%

Significant when α = .05

ZINC = AVEINC / 10,000

leted because of high collinearity with dependent variable.

collectively predict each respective dependent variable, and therefore well-being, very adequately. However, in individual terms, not all of the variables remain significant for all of the equations. Thus, using the two-out-of-three 'rule' established earlier, only the variables which are significant in at least two of the models are considered as definite indicators of university-influenced well-being. And, in fact, ten such variables fit this requirement (and are listed on the top of Figure 4.6). It is, however, slightly short-sighted in judgement to assume that the remaining university-distinct variables are unambiguously not effecting well-being and simply consider them as irrelevent to this exercise.

There are several variables that are highly correlated with these ten 'most important' predictors of well-being and therefore, in some degree, echoing a similar effect on the dependent variable in question. Thus, for completeness, variables that were clearly correlated (greater than 0.7) with any of these ten variables were retained for interpretation purposes. The second listing on Figure 4.6 are these highly-related, but non-significant, variables. Whereas, the third category can safely be eliminated from consideration here because they are not causally related with well-being (as the first group is) nor are they correlated with the variables that are causal (as the second category is).

So, a number of variables, representing a wide-range of socio-economic criteria, have emerged from regression models featuring very admirable R-squared values. It should be realized that the residuals, or the difference between the actual and predicted values for the dependent variable, for each of the three models do not show an appreciable bias in any fashion and therefore help validate the results attained. As Table 4.11 shows, given the 266 observations, the models collectively are as likely to over-predict as under-predict well-being. And, generally, when one considers the 37 university census divisions in isolation, a similar result emerges with possibly a slight tendency for the three models to under-predict well-being. It seems reasonable to claim that

Figure 4.6

THE EFFECT OF THE ANALYSIS' 30 VARIABLES ON WELL-BEING

Definite Indicators of Well-being

BORCAN
PUBDE
OMA
OCLER
FORES
HIGHI
TRAD
HOUSV
MPR
OSERV

Probable Indicators of Well-being

ALLIN
MIGOCA
FINA
UWOD
ONSEM
COMBU
FP1524
FPR
ARENT
MNOLF
OSALES

Unlikely Indicators of Well-being

(
[illegible]
POPDEK
FNOLF
UWD
SFT
LOWINI
OSS
CMA

Table 4.11

RESIDUAL RESULTS

Total Census Divisions (266)

	AVEINC	LABR	QUAT
Over-predicted	112 (42.1%)	111 (41.7%)	123 (46.3%)
Under-predicted	113 (42.5%)	117 (44.0%)	107 (40.2%)
Perfectly predicted	41 (15.4%)	38 (14.3%)	36 (13.5%)
	266 (100%)	266 (100%)	266 (100%)

University Census Divisions (37)

	AVEINC	LABR	QUAT
Over-predicted	19 (51.4%)	17 (46.0%)	9 (24.3%)
Under-predicted	14 (37.8%)	13 (35.1%)	25 (67.6%)
Perfectly predicted	4 (10.8%)	7 (18.9%)	3 (8.1%)
	37 (100%)	37 (100%)	37 (100%)

no real bias exists in the residuals and, therefore, the violation of an important assumption for regression analysis has not been comitted. As a result, the interpretation of the general well-being model can justifiably be pursued.

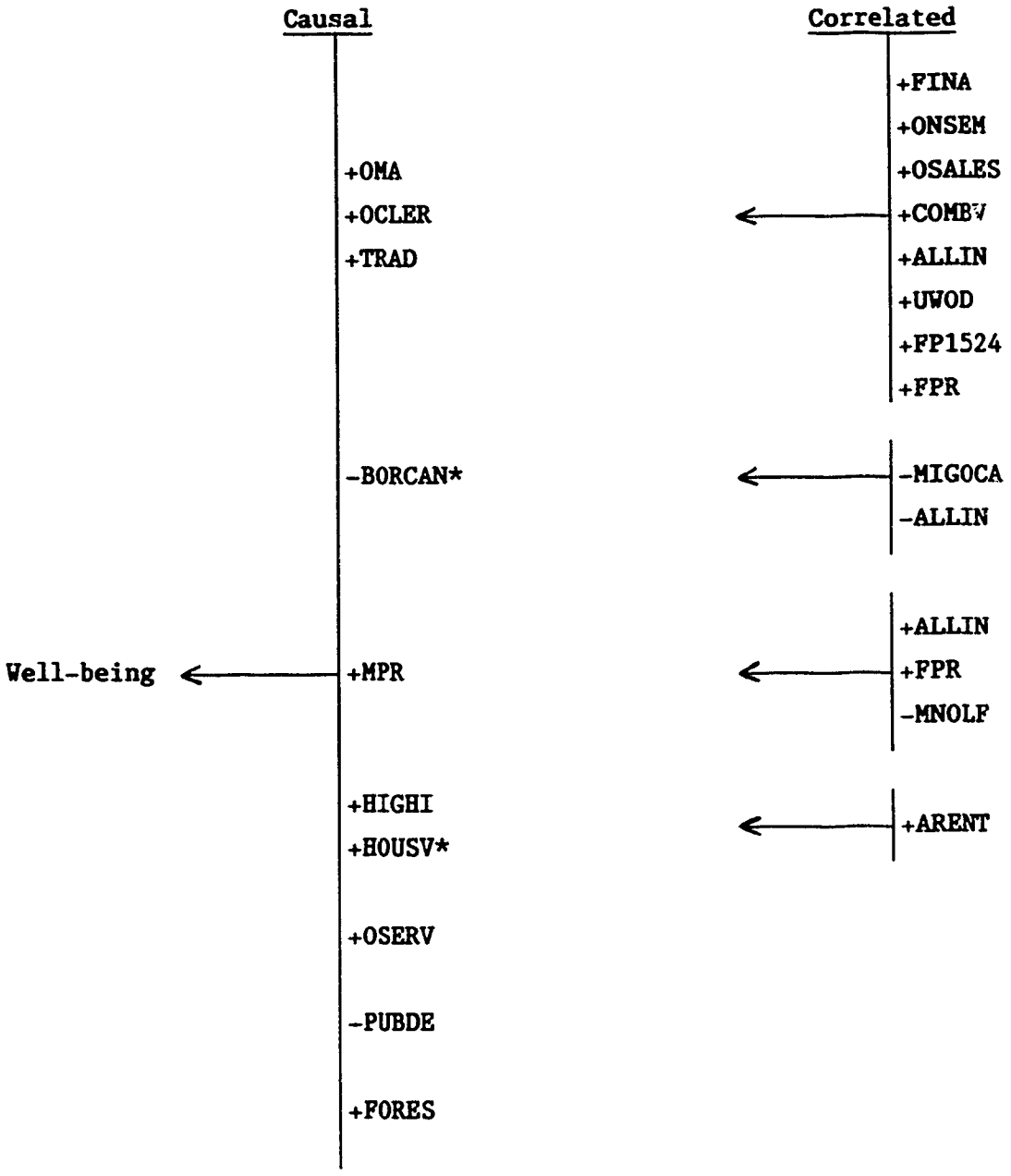
4.4.2) Interpretation of the Well-being Regression Model

It should be emphasized that the main thrust of this section is concerned with understanding how the designated ten most important socio-economic variables (upper portion of Figure 4.6) effect university-influenced well-being. In order to properly do this, however, it is also important to address two other issues: the direction of effect that these variables have within the well-being equation, and the other variables that are highly correlated with these apparent well-being indicators

Figure 4.7 illustrates how these issues will be conceptually handled and deserves some closer attention. Looking firstly at the so-called 'causal' components, or the 'b' values of the well-being model, the direction of effect on well-being is given by either a positive or a negative sign but the explanation behind this conclusion can be slightly ambiguous. It must be remembered that this well-being equation is made up of only variables that emerged significantly in at least two of the original three regression models and therefore the potential exists for the signs of the 'b' values to be conflicting for any of the ten independent variables. And, in the case of BORCAN, TRAD, MPR and HOUSV, this is exactly the situation that occurred, as Table 4.10 reveals. In order to understand how this problem was rectified it is necessary to consult Figure 4.5 once again. In the event of conflicting 'b' values for any of the predictor variables, the direction of effect was determined in accordance with the partial correlation coefficient. The partials are an indication of how a single independent variable relates to a dependent variable and should be consistent with intuitive reasoning. Logically, a 'b' value that is alligned with the partial will create a stronger

Figure 4.7

CONCEPTUAL FRAMEWORK FOR VARIABLE INTERPRETATION



* Probably represents a more 'descriptive' than 'causal' relationship with well-being.

conclusion with regards to the true direction of effect than when the signs are opposing.

Also listed on Figure 4.7 are the correlated components and to which causal variables they are related to. And, in some cases, there are several highly-linked variables, both in the causal and correlated categories, that (because of their relatedness) are best interpreted as a unit.

The first rather large grouping of inter-related variables are causally represented by OMA, OCLER and TRAD which are inturn correlated with FINA, ONSEM, OSALES, COMBU, ALLIN, UWOD, FP1524 and FPR. Notice that all relationships are positive and that every variable considered within this particular unit has a higher mean value for the 37 university census divisions relative to the rest of Canada (as shown on Table 4.12). The higher concentration of managerial, clerical and trade occupations seems to be contributing to the higher level of well-being exhibited in university census divisions. And, employment in all industries (ALLIN) but particularly in finance, natural science, engineering, mathematics, sales, computers and business are, in some degree, effecting well-being as well. Many, if not all, of these occupations are closely associated with the service sector, as opposed to resource or manufacturing categorizations, and in some cases the quaternary sector. The high-technology influence is definitely evident here as many endeavours inherent to these activities are clearly in the upper echelon of employment description (with resource-intensive occupations being at the bottom). So, the higher concentration of those employed in service and quaternary occupations in university communities is a contributing factor in explaining why these areas are prosperous.

The fact that the variable UWOD surfaced within this unit of prodominantly high-tech-type employment variables is quite expected since these jobs do tend to require highly educated individuals.

A little less expected is the high-relatedness of the female participation rates (both FPR and FP1524) in the absence of any of the male indicators. Seemingly, the female workforce has

Table 4.12

WELL-BEING 'PREDICTOR' VARIABLES - MEANS FOR THE GROUPS

VARIABLE	UNIVERSITY	ADJACENT	REMAINING
OMA	.0424	.0312	.0309
OCLER	.0912	.0602	.0597
TRAD	.0820	.0672	.0649
FINA	.0241	.0146	.0147
ONSEM	.0166	.0093	.0095
OSALES	.0443	.0336	.0321
COMBU	.1536	.1105	.1120
ALLIN	.4838	.4411	.4315
UWOD	.0675	.0347	.0335
FP1524	61.8522	52.9431	52.3636
FPR	51.6151	44.9410	45.3105
BORCAN	.8611	.9111	.9236
MIGOCA	.0193	.0098	.0120
MPR	77.4392	75.2051	74.4398
MNOLF	.0839	.0930	.0946
HIGHI	.1099	.0815	.0884
HOUSV	65772.8378	49606.9897	49558.0606
ARENT	305.4865	259.8247	252.4924
OSERV	.0633	.0522	.0520
PUBDE	.0467	.0315	.0326
FORES	.0038	.0079	.0160

become very pronounced in, especially, high education-type jobs.

Therefore, the localized prosperity of university communities appears to be partially a result of the higher proportion of service and/or quaternary occupations (relative to the rest of Canada) common to these regions. And, by the very nature of these jobs, they tend to attract well-educated people; an outcome that must certainly benefit the university community as well. In addition, at least with respect to these high education positions, the importance of the female component of the labour force has emerged noticeably.

The second unit of variables, BORCAN and its correlated counterparts MIGOCA and ALLIN, can generally be classified as a 'place of birth' categorization. Note that BORCAN has an inverse relationship with well-being but, at the same time, exhibits a lower mean value for university census divisions in comparison to the rest of Canada. As a result, this outcome can be viewed as supportive of the university growth-pole argument; in that, well-being is increased in university census divisions by a relative absence of people born in Canada. And given that the 'migrants form outside of Canada' variable is negatively correlated with BORCAN, both variables are essentially measuring the same characteristic. Seemingly, the higher economic prosperity, in the form of a greater number of people employed in all industries (-ALLIN), is attributable to a higher concentration of non-Canadians residing in university communities. Yet, from this statement it should be obvious as to why this outcome cannot be faithfully deemed as causal. Such that, being born in Canada should not disadvantage one from gaining employment and/or achieving higher than average levels of economic well-being. This result is more an 'indication' or 'description' rather than a 'cause' of well-being superiority in university areas and should be interpreted as such. Never-the-less, an important social characteristic of university communities has been uncovered here; namely, that these areas do seem to possess a large proportion of skilled immigrants and an apparent lack of the less fortunate portion of the Canadian-born populatior..

Causally related to well-being is the male participation rate. Highly-correlated to this variable is the female participation rate, those employed in all industries and a negatively related 'males not in the labour force' variable (which is therefore essentially measuring the same thing as MPR). It is interesting to note that although the female employment indicators are correlated widely with many of the analysis' variables, never are they causally associated with well-being. From a sociological standpoint, does this suggest that although the female workforce has indeed become more pronounced in recent times and seems to be especially critical to the service and quaternary sector, it is the level of male employment that continues to be more vital to the immediate economy's overall 'health' in, at least, university growth regions? Such an interpretation is consistent with the results attained and does perhaps indicate that the importance of the sexes in many of the university-influenced communities is not as of yet equal.

House value, again not a true causal influence on well-being is, along with average rent, still a good indicator of social and economic condition. Specifically, growing regions that are economically advantageous and generally free of social unrest symptoms will usually feature higher house values. And, relatedly, higher than average rents usually indicate an increasing demand to live within an area that is prospering. If these high-priced accomodations are to be afforded, then the attraction of high-income earners into the region seems inevitable. Thus, as Figure 4.7 illustrates, the inter-relationship of HIGHI, HOUSV and ARENT is intuitively understandable and the higher than average mean values for each of these variables in university communities helps to high-light the prevailing prosperity common to these 37 census divisions.

Those employed in services trades is a variable that is causally linked with well-being and is strangely not highly-correlated with any other variable. In any case, as has been established, a prime reason for a university community's economic success has to do with the abundance of local tertiary activity.

The last two components of the well-being regression equation, PUBDE and FORES, both tend to 'work against' the university growth-pole argument. There are more people employed in public administration and defense in the 37 university census divisions but this variable is inversely linked with well-being. Evidentally, these jobs do not encourage a higher standard of individual prosperity relative to other occupations in Canada. Conversely, forestry activity does positively effect well-being, as resource-intensive jobs do tend to pay well, but there is a comparative lack of these jobs in university census divisions. So, PUBDE and FORES are two independent variables of the well-being regression equation that cannot be interpreted in favour of the university census division; yet, their negative effects are well-compensated by the positive influence of the variables discussed earlier.

The next chapter will offer some concluding remarks, including a rationalization of why the CMA variable failed to emerge, and discuss these results in the light of government policy potential.

CHAPTER 5 - CONCLUSIONS

Therefore, with the proposed issues addressed, perhaps a good way of concluding this aggregate study is to examine how well the questions formed at the beginning of Chapter 4 have been answered. It was generally determined that universities are acting as growth-poles in Canada and, through the indications of three out of four of the well-being surrogates, promoting prosperity within the regions in which they dwell. Also, quaternary employment was significantly higher in university census divisions, revealing that the often proposed university-high-tech industry attraction appears to have manifested in Canada's socio-economic landscape. And although these above conclusions can be viewed as very positive outcomes, this greater level of prosperity and high-tech emphasis remains very local, at least, not beyond the actual university census division boundary. Thus, university growth-poles have emerged and have promoted the formation of growth-centres but the spread effects have not sufficiently benefited the surrounding periphery.

Some interesting causal effects, along with a few descriptive characteristics, were uncovered as to why universities seem to promote a strong local economic influence. University census divisions seem to be positively influenced by greater levels of service and quaternary activity, male labour participation and high income earners. As well, the typical university region will display a greater proportion of foreign-born people and higher average house and rent values relative to other Canadian destinations. However, the greater number of people employed in public administration and defense occupations and the comparative lack of forestry endeavours in the 37 university census divisions have the effect of 'reducing' well-being; but, evidentally, not enough to disrupt the overall aggregate pattern of 'university community prosperity'.

The non-emergence of the CMA indicator as an important variable in the well-being regression procedure reveals that perhaps the forces of urban agglomeration have not 'clouded' the true effect

of universities on their surroundings as much as what was originally anticipated. This can be interpreted as a positive occurrence, from the stand-point of this project's validity, because by considering the university effect in aggregate it appears that the simultaneous influences of urban clustering and university growth-poles have been adequately separated.

Yet, when looking at each university situation separately, it is certain that the urban effects will not so easily be discounted; and probably rightfully so, because the influence of urban agglomeration should, theoretically, be understood. A residual analysis that divides the 37 university census divisions into a regional categorization, . es on this more individual-case emphasis and was briefly pursued.

As it turned out, the 37 university census divisions displayed the same regional pattern of disparity that a well-being study using all 266 census divisions would have typically uncovered. The university census divisions in the Maritimes were clearly over-predicted by the well-being model (meaning that the actual levels of economic well-being for the Maritimes is less than what the model predicted on the strength of the independent variables). Ontario is typically under-predicted and British Columbia, the Prairies and Quebec are as likely to be under- as over-predicted. In other words, with respect to encouraging prosperity, university growth-poles vary in an effectiveness that seems to be, in part, related to the regional conditions prevailing. And given the pattern that has emerged in the residuals, it is likely that the more urbanized a region is, the stronger will be the university-pole.

Thus, by looking at the university census divisions either individually or regionally, it is inevitable that the effect of urban agglomeration will be displayed far more clearly than it was when all 37 census divisions were considered simultaneaously. However, since this issue is really beyond the boundaries of an aggregate discussion, it will only be introduced here.

At any rate, the results of the aggregate analysis have implications for government policy. It

was established that universities can aid a community in a wide-array of social and economic capacities and, as potential vehicles for regional development, it seems entirely reasonable to contemplate actual university growth-pole applications. However, it must be reinterated that this positive university effect is spatially localized and, as a result, by placing a university-pole in a slow-growth region, only spatially immediate benefits are likely to occur. If more encompassing regional reforms are necessary, the use of the university-pole analogy as an instrument of government policy must follow one of the following two general approaches: either more than one university campus must be strategically placed in economic space, or the development of a university-led research area (park) must be established.

As the Scandanavian illustrations revealed in Chapter 2, by spreading university resources throughout a 'troubled' region, a balancing of well-being between the 'haves' and 'have-nots' in society can be attained. But a probably more 'dramatic' regional development university-influenced program involves the establishment of so-called 'research parks'; such as what has been witnessed in the Silicon Valley, Route 128 and North Carolina situations. The successes of these applications clearly shows that the collaborative efforts of both universities and high-tech industry is undoubtedly the most effective way of utilizing any type of university growth-pole analogy. Simply, the university attracts growth-oriented technology-driven industry which, in turn, develop the region.

Nowhere in Canada is there any such research park entity that can rival any of the American experiences but the Kitchener-Waterloo-Guelph-Cambridge dubbed 'Technology Triangle' has some potential (Ministry of Industry,Trade and Technology,1989,1). Driven by the presence of three local universities (University of Waterloo, University of Guelph and Wilfrid Laurier University), the attraction of high-tech industry into the area is occurring and the region has emerged as one of Southern Ontario's true growth-centres. It is, however, too early to pass

judgement on the potential for this region to become one of the thriving high-technology-based focal points in North America, as has been suggested could occur.

At any rate, universities clearly have a place within the realm of regional development policy; however, the detailed particulars concerning how a government might successfully use the university-pole is really another topic for a future dicussion.

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